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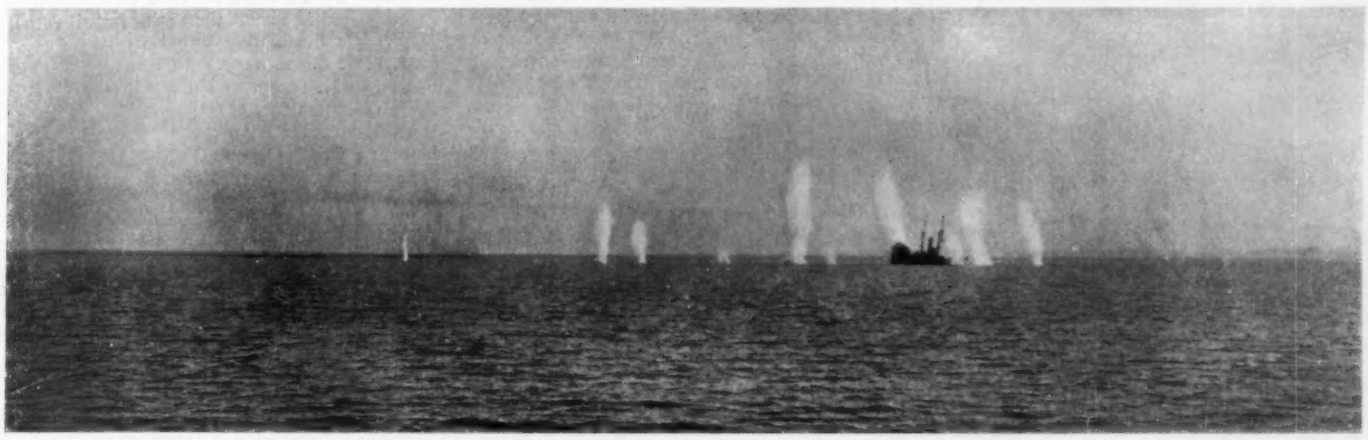

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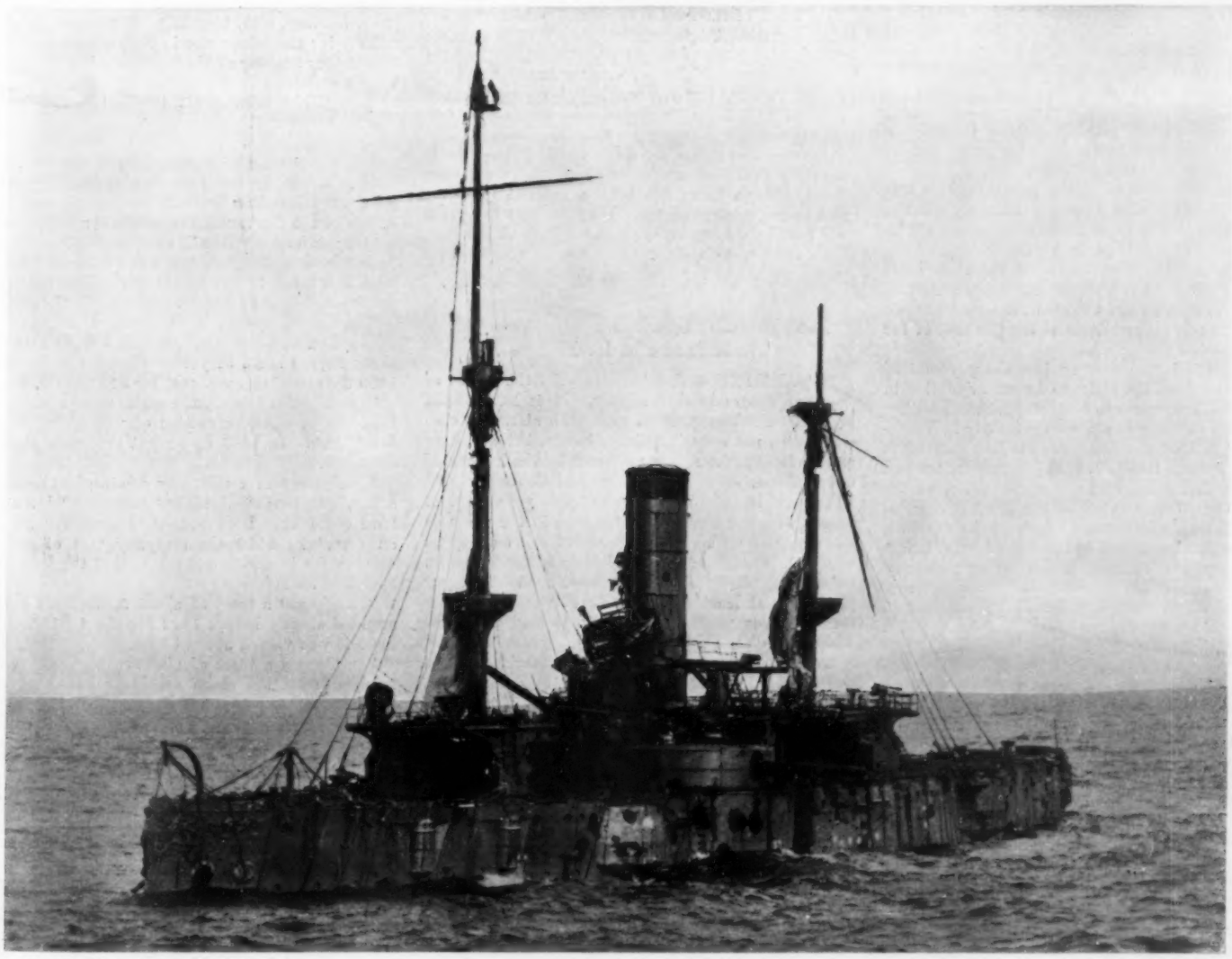
This is what the observers, anchored a mile away and at right angles to the line of fire saw, as the salvos struck the water. This is the splash of four 12-inch and four 8-inch shells, fired from the "New Hampshire," six miles to right of the "San Marcos."



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The "San Marcos" during an interval in the firing. She has sunk a few feet and is on the bottom. The gaping holes at the waterline are clearly visible.

SINKING A BATTLESHIP AT SIX MILES.—[See page 330.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately and in simple terms, the world's progress in scientific knowledge and industrial achievement. It seeks to present this information in a form so readable and readily understood, as to set forth and emphasize the inherent charm and fascination of science.

Why Not Revive Preferential Duties?

IN the year 1810, ninety per cent of the commerce of the United States, and a considerable part of that of foreign nations, was carried by American ships. Furthermore, American shipping registered for over-sea commerce had grown from 123,000 tons in 1789 to 981,000 tons in 1810. Today, not only is our share in the carrying of foreign commerce practically nothing, but our merchant marine is declining so fast that the day of its ultimate extinction is in sight; and although our foreign trade has grown to the enormous total of three billion dollars, we are dependent upon foreign ships for its transportation, and are paying the foreign ship owners annually in freight charges, a sum of about three hundred million dollars.

What was the attitude of the government, which so wisely fostered the shipping industry of the young republic as to cause American deep-sea tonnage to increase eightfold in a little over two decades? The explanation, so far as the attitude of the government is concerned, is very simple. On all freight imported into the United States in American bottoms, there was a remission of ten per cent of the customs duties.

In view of the prejudice against the payment of ship subsidies (and the history of recent agitation in favor of subsidies seems to indicate that the hostility is nation-wide) there is a growing feeling in Washington that if federal assistance is to be rendered, it must take a form that is less objectionable, we had almost said irritating, to the susceptibilities of the public. Why, then, in view of the great success of preferential duties in the early days of the republic, should they not be revived in this era of great industrial development and expansion of our foreign trade? No one would now ask for a ten per cent rebate; one of five per cent would be sufficient in these days of high tariff. We commend the question to the consideration of the readers of the SCIENTIFIC AMERICAN, and shall be glad to throw open our correspondence columns for a discussion of the problem.

Our Naval Guns and Powder

IT cannot be denied that in the contest between guns and armor, the most powerful rifled guns of the day have established a considerable lead. Such, at least, is the impression which we derive from a perusal of the annual report of Admiral Mason, Chief of the Bureau of Ordnance of our navy. We have in mind the very significant fact that in the recent gun-versus-armor experiments, carried out on the Potomac, the 45-caliber, 12-inch gun easily penetrated at a range of 8,000 yards, the 10-inch curved armor plate which had been erected upon the obsolete ram "Katahdin." This gun is of the same type as that carried on the "New Hampshire." Since her day, however, a 50-caliber, 12-inch gun of greater power has been developed, which will form the armament of the "Arkansas" and "Wyoming;" furthermore, on the "New York" and the "Texas" will be mounted ten 14-inch, 45-caliber guns of much greater power even than the 50-caliber, 12-inch. The Bureau of Ordnance is to be congratulated on the fact that they foresaw, several years ago, the return to guns of caliber larger than 12 inches, and built, accordingly, a type gun of 14-inch caliber. This gun has given excellent results in trial firings, and thus the navy is furnished with a well-proved type, ready to be built and mounted upon our latest battleships. The introduction of guns of large caliber has called for a new design of turret mounting, and a preliminary plan, drawn up in 1908, has been adopted with certain necessary modifications.

Although the "Wyoming" and "Arkansas" were designed with turrets having two-stage ammunition hoists, it has been determined, in view of the very great success with manual ammunition handling and loading in the 12-inch turrets of the "Louisiana" and "Vermont," to adopt a somewhat similar system for our later ships. The turrets for these will therefore have a hand powder supply all the way from the magazines to the guns. A larger number of shells will be stowed in the gun chambers, and in the upper handling rooms below them, the remainder being in the regular shell room. The gun chambers, however, will be effectually sealed from the handling rooms at all times. During the year, steady progress has been made in renovating the ordnance upon the eleven battleships out of commission.

No changes of importance have been made in the smokeless powders; the aim of the powder factory has been to improve the quality of the present output. We are glad to note that there has been a steady increase in the output of this very efficient factory, a matter which will prove of great importance in case of hostilities. During last year the factory turned out 1,660,686 pounds of smokeless powder, of which 831,542 pounds were "re-worked." The present policy is to withdraw inferior powders and re-work them into a proper condition without waiting for alarming evidence of deterioration. All new ships are being fitted with cooling systems for the magazines.

As usual, the projectile question is causing anxiety on the score of the limited supply of perfectly satisfactory shells. At the same time, it is gratifying to learn that a new form of projectile (we presume with a longer and sharper conical head) has been adopted, which, for a given initial velocity, has a greater range and shows a considerable increase of striking velocity and penetration at long ranges. The advance of armor, on the other hand, has not been entirely satisfactory so far as thick plates are concerned, though there has been a marked improvement in the thinner plates. We note that the price paid for Class A armor, which comprises 90 per cent of the total, was $430 per ton. The navy should be getting its armor for less than this.

The Private Ownership of American Timberland and Its Menace

STANDING timber is necessarily the source of our future lumber supply. It is but natural that thinking persons view with alarm its concentration, not only in private hands, but in a few private hands. A report prepared by the Bureau of Corporations of the Department of Commerce and Labor and issued in February of this year deals at length with the tremendous increase in the value of the standing timber in all parts of the country as well as with the extent to which, in a few years, its ownership has gradually narrowed. While forty years ago at least three-fourths of the timber now standing was publicly owned, it is said that now four-fifths of it is privately owned.

To quote the report: "Examples of the increase during this interval are: From $5 to $30 an acre, $7 to $40, $20 to $150, $1 to $13, $4 to $140, $1 to $50. Specific tracts have been sold first for $24,000, and later for $153,000; $10,000, and later $124,000; $240,000, and later $2,500,000; $23,000, and later $500,000; $19,000, and later $1,125,000. These examples illustrate the remarkable profit made by certain individual holders.

"What did the Government get for the timber? Of the southern pine, sold for $1.25 an acre, much is now worth $60 an acre. Large amounts of Douglas fir in western Washington and Oregon, which the Government gave away, or sold at $2.50 an acre, now bring from $100 to $200 per acre. The great redwood belt in California was alienated on similar terms, and some of it is now worth hundreds of dollars an acre. Practically none of the great forests in the public-land States was sold by the Government for more than $2.50 an acre. The great increase of value gives grave importance to the concentration of ownership."

The report leads us to think that five-elevenths of the country's privately owned standing timber is in the Pacific-Northwest (California, Oregon, Washington, Idaho and Montana), one-half of which is now controlled by thirty-seven holders, many of whom are closely connected and the three largest of whom alone own nearly one-fourth.

As to the largest holder the Government report says:

"The Southern Pacific Company holding is the greatest in the United States—106 billion feet. This is about 6 per cent of the private timber in the investigation area, and 10 per cent of that in the Pacific-Northwest. It is difficult to give an adequate idea of its immensity. It stretches practically 680 miles along that railroad between Portland and Sacramento. The fastest train over this distance takes 31 hours. During all that time the traveler thereon is passing through lands a large proportion of which for 30 miles on each side belongs to the railroad, and in almost the entire strip this corporation is the dominating owner of both timber and land. . . . A very significant fact in connection with this enormous holding is that the Southern Pacific Company is not selling its timber, but is holding this valuable supply, evidently in the confident hope of a further great advance of price."

Concerning the second and third largest holdings, the Government report has this to say:

"The holding of the Weyerhaeuser Timber Company (including its directly owned subsidiary concerns) is the second largest in the United States, amounting to 95.7 billion feet. This is only about 10 billion feet less than that of the Southern Pacific. Most of this timber—nearly 77 billion feet—is in Washington; about 18.7 billion feet is in Oregon, and an insignificant fraction in California. It is chiefly Douglas fir.

"It should be repeated that this holding, enormous as it is, includes only the timber directly owned by the Weyerhaeuser Timber Company and its subsidiary corporations. It does not include further very extensive timber interests of members of the Weyerhaeuser family and their close associates. This great holding, also, is nearly all being held off the market for the future rise in timber values. . . . The timber holding of the Northern Pacific Railway Company, which ranks third in importance, amounts to 36.2 billion feet. This, it will be seen, is much less than either the Southern Pacific or the Weyerhaeuser holding.

The extraordinary increase in the value of timber land is shown in the following especially striking instances taken directly from the field reports of the agents of the Bureau of Corporations:

"One informant stated that in 1895 a tract of timber land in Virginia was offered him for $3,500, and he refused to buy it. 'Later' (date not given) the tract was sold for $48,000, a thirteenfold increase.

"In Louisiana, in 1882, a firm bought a tract of about 19,000 acres of yellow pine for $19,000. In 1909 the same tract was sold for $1,125,000.

"In Michigan a lumberman was offered, but failed to purchase, a section of white pine in 1883 for $3,200. In 1895 he bought the same piece for $125,000.

"In Wisconsin a company owning hemlock, tamarack, and hardwood timber lands stated that this land could have been bought in 1898 for 50 cents an acre. In 1906 the company was offered $16 an acre for it, and in 1908 it valued the lands at at least $30 an acre.

"In Oregon a tract of about 5,500 acres was assembled shortly before 1892 for about $24,000. In 1909 it was valued above $1,000,000.

"In Oregon a tract of about 3,500 acres was assembled from the claim holders in 1896 at about $800 or $900 per 160-acre claim. The present valuation is at the rate of $41,760 per claim, a fifty-fold increase upon the price which the original claim holders received fifteen years ago.

"In Oregon, again, a tract was bought in 1900 for $36,000, and in 1908 was held at $425,000."

Apart from the concentration of timber ownership outlined above, there is another problem possibly of greater importance, which has been referred to as a "sinister land concentration." After all timber has been cut off, the land may be adapted for a new growth, this leading to a perpetuity of the standing timber monopoly, while a large portion of the land will be suitable and exceedingly valuable for agricultural purposes. The acres of land thus involved run into many millions, and the power involved in such land concentration irrespective of the timber values is difficult to estimate. Especially is this so with a few of the largest owners occupying dominating positions as to railroad transportation over large sections of the country.

Edouard Branly

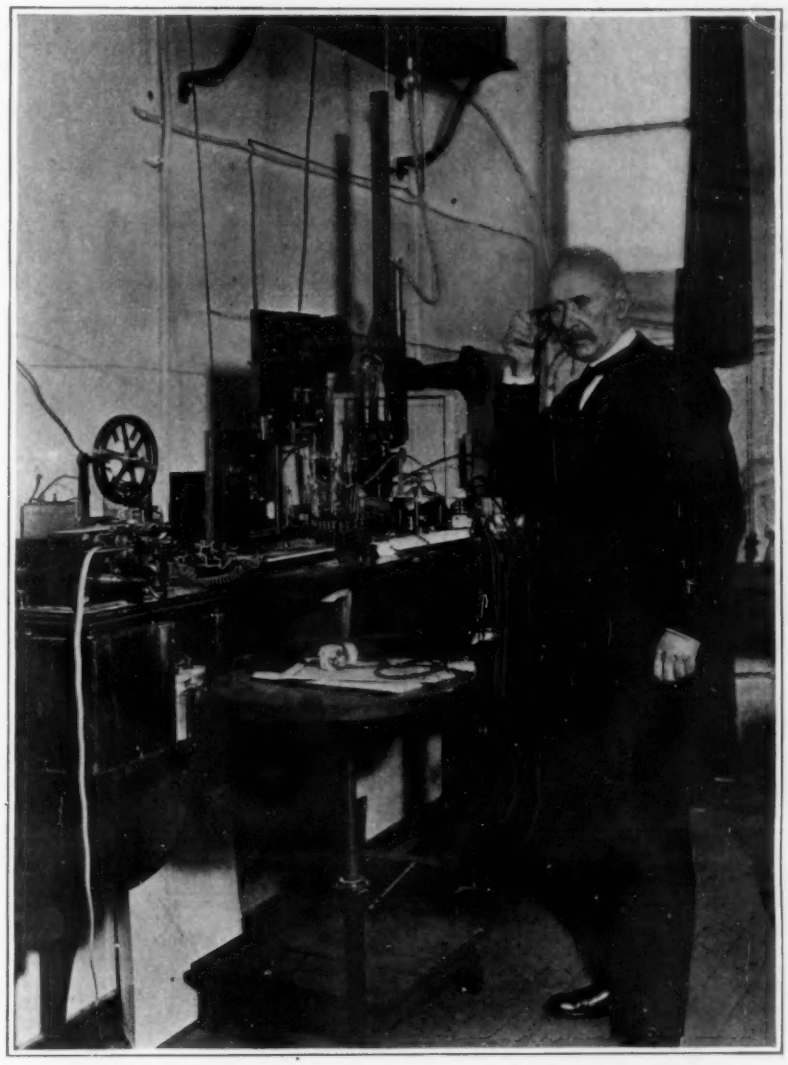
The Successful Rival of Mme. Curie at the Paris Académie des Sciences

By P. F. Mottelay

EDOUARD BRANLY, who was recently elected to fill the Gernis vacancy at the French Académie des Sciences by a majority of only two votes over Mme. Curie, was born at Amiens on the 23rd of October, 1844. He made his first studies at the College of St. Quentin, and, after following a course at the Collège Henri Quatre, in Paris, was admitted at the Ecole Normale Supérieure in the last-named city. The completion of his studies had brought him a Fellowship at the French University and the degree of Doctor of Physical Science, as well as that of Doctor of Medicine. He then became Professor at the College of Bourges and subsequently was appointed Director of Physical Instruction at the Sorbonne, which post he retained up to the year 1876, when he commenced a series of lectures in Natural Philosophy at the free school for advanced students.

Professor Branly has been indefatigable in his electric researches and has made many very valuable discoveries, as will be seen by reference to the *Comptes Rendus* of the French Academy of Sciences, as well as to the different scientific publications of the time.

The results of his most important early investigations are recorded in a volume published in Paris during 1902, "Télégraphie et Téléphonie sans fil récepteur...," which naturally attracted world-wide attention, for in it he brought forth the all-necessary receiver that has proved such a factor in the development of wireless telegraphy. His discovery of electro-static phenomena in batteries, positive discharge by gases, violet rays and incandescent bodies, were no less brilliant. For his exposition of radio-conductors, the Paris Academy of Sciences awarded him the Houllevigue prize, and the International Jury of Superior Precept Instruction gave him a *grand prix*. For his remarkable work done from 1898 to 1900 in wireless investigations the French Minister of Public Instruction made him a Chevalier of the Legion of Honor, and Pope Leo XIII. invested him with the Order of Commander of St. Gregory the Great.



EDOUARD BRANLY: A PIONEER IN WIRELESS TELEGRAPHY

During the past twenty years Prof. Branly has brought forth many improvements to his previous discoveries. He has introduced among other apparatus, new radio-conductors with tempered and polished steel contacts for wireless telegraphy, new independent distributing contrivances for producing tele-mechanical effects without wires, and, some four years ago, he constructed safety apparatus independent of all syntonization to prevent the action of accidental sparks in these same tele-mechanical effects. He has also done much toward solving the problem of maintaining secrecy of communication between transmitting and receiving stations.

Of late the Professor has awakened still greater astonishment by his reported progress in tele-mechanics proper. He has shown that, without possible interference by electric atmospheric disturbances, he can start and regulate machinery, discharge artillery, operate mines, start the lamps in lighthouses, etc., by wireless, at as great a distance as 150 miles, and that a system of reflected waves will enable him to observe the resulting operations. Some of the explanatory details of this have already been disclosed in these columns.

Electrolytic Iron—Can It be Made an Industrial Product?*

By Charles F. Burgess

DURING the past five years investigations have been carried on in the chemical engineering laboratories of the University of Wisconsin, dealing with electrolytic refining of iron and its use in the production of alloys. About three tons of iron have been refined and over 1,000 alloys produced and tested. While this experimental work has been on the "test tube" or laboratory scale, it is believed that some of the results indicate the feasibility of enlargement to commercial state, and a short discussion is submitted here bearing on the question, "Can electrolytic iron be made an industrial product?"

Many old textbooks on electro-chemistry give descriptions of methods of depositing iron electrolytically, implying, therefore, that electrolytic iron is not a new product. The only use suggested, however, is for facing engraved plates used for printing. By following any of these earlier processes it is seen that only very thin layers of iron can be deposited, the coating tending to become dark, rough and powdery. It is to overcome this limitation that the work at the University of Wisconsin was undertaken, and that this has been successful, in a measure, is indicated by an iron cathode nearly 2 inches in thickness.

THE FIELD FOR ELECTROLYTIC IRON.

The manner in which electrolytic refining has revolutionized the copper industry is now an old story, and electrolysis has likewise become an industrial agent in the metallurgy of silver, gold and lead. Now, that it has been found that iron can be refined electrolytically almost as easily as copper, it is pertinent to inquire whether there is a field of usefulness for such iron. This depends upon whether electrolytic iron has superior qualities due to purity or physical condition, and whether it can be procured at low cost.

From the standpoint of purity it must compete with some notable metallurgical developments which have resulted in product such as being made by the American Rolling Mill Company in a basic open hearth process. For this material a purity of 99.94 per cent is claimed, and justifiably so, as some of our analyses show. The electric furnace is another factor which is contributing largely to the control of the composition and purity of iron alloys, and the striking possibilities which are offered in this developing field cannot be overlooked in advocating the development of an electrolytic iron process.

The chief source of commercially pure iron has been and, perhaps, now is, the high grade Swedish and Norway iron, used largely as a base material for high grade crucible steel. The analyses of this material usually indicate a high purity, though frequently and erroneously calculated by difference, after determining carbon, sulphur, silicon, phosphorus and manganese. It is not uncommon to find oxides and slag to the extent of 2 per cent in this material, and this impurity undoubtedly may have an influence on the resulting alloys made from it.

ELECTROLYTIC IRON 99.97 PER CENT PURE.

We have found that electrolytic iron can be produced with a purity as high as 99.97 per cent, and, perhaps, even better, using extraordinary precautions. This record has been made by using the best commercial grades of pure iron as anodes. A few hundredths of 1 per cent of purity must be sacrificed in using anodes of mild steel or other less pure materials. Electrolytic refining offers a means of reducing or screening out most of the impurities commonly found in iron and of producing a material not only of high purity, but of great uniformity. Even though it may be shown eventually that electrolytic iron may not have a higher purity than that attainable by other methods, the uniformity of its composition should make it a valuable material as a means of eliminating many of the variables with which the crucible steel maker has to contend.

Using an electrolyte containing 40 grammes of iron per liter in the form of ferrous sulphate, together with 40 grammes of ammonium chloride, it has been found possible to conduct a continuous refining operation for many months at a current density of 6 to 10 amperes per square foot of cathode surface, and at a potential difference of about 1 volt. The current efficiency is very close to 100 per cent, as it is in copper refining.

A CALCULATION OF COST.

This leads to the calculation that 1 kilowatt hour will refine 2 pounds of iron; or a cost for power of ½ cent per pound is attainable. The costs for labor, solution maintenance and fixed charges are estimated to be not greater than the power costs, making a cost of refining of about $20 per ton. Assuming the anode material to be a mild steel costing $35 per ton, the cost of electrolytic iron would be in the neighborhood of $55. These approximate calculations indicate that this material might well compete in price with high grade Swedish iron.

Among the properties of electrolytic iron which may give it some added usefulness is its contents of hydrogen and the brittleness which results from this occluded gas. This hydrogen may be of some service in reducing oxides in a melt. The brittleness of the electrolytic iron before the hydrogen is driven off makes it easy to break it up into pieces suitable for introduction into the steel crucibles.

* A paper read before the Chicago section of the American Electrochemical Society.

Aviation Exploits at Home and Abroad

Foulois on the Mexican Border; the Flight to the Puy de Dome

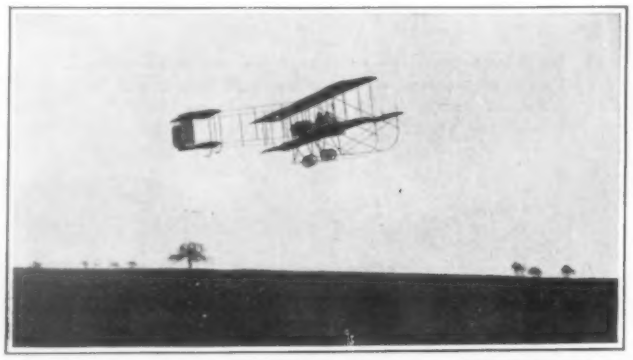
The Wright Army Biplane

ONE of our illustrations shows the Wright biplane which was recently loaned to the army by Mr. Robert F. Collier, in flight above the camp at San Antonio, Texas. Lieut. B. D. Foulois and Aviator Philip Parmalee have made some excellent scouting flights in Texas recently with this machine. The chief of these was made on March 3rd, when they flew from Laredo to Eagle Pass, an air line distance of 104½ miles, in 2 hours and 7 minutes. By following the Rio Grande they covered about 106 miles actual distance, their average speed being close to 50 miles an hour. On the return trip the machine met with an accident and landed in the river. It was transported back to camp, and, after repairs had been made, some more excellent scouting flights were accomplished. On March 18th they flew for several minutes in the pouring rain, thus demonstrating that the aeroplane could be used even under extremely adverse conditions. The Signal Corps acquired last week its first Curtiss biplane, and this has been taken to Texas for use at the maneuvers. The original Wright biplane which belonged to the Signal Corps has been returned to the factory for remodeling. It is probable that in addition to this the army will have several more Wright and Curtiss machines for use in the near future.

The Winning of the Michelin Grand Prix

ON the need of the aviation world of a grand prize for a stupendous feat, the Michelin brothers—France's great tire manufacturers—based their $20,000 prize three years age. The great flight they proposed was one of 222 miles from Paris to the Puy de Dome mountain, a 4,813-foot peak located near their works at Clermont-Ferrand. The aviator must carry a passenger and make the flight within the elapsed time of six hours, circling the Arc de Triomphe at Paris at the start and turning about the steeples of the cathedral at Clermont-Ferrand before the finish. As the summit of the mountain afforded a very constricted landing place, it was generally supposed that an aviator attempting to land upon it would demolish his machine and perhaps be killed or seriously injured; and consequently, a month or two ago, the Michelins attempted to modify the rules to read that a safe landing must be made without breakage of the machine. This modification was not allowed, but Renaux fulfilled it nevertheless.

At the time the Michelin prize was offered, the best records abroad were for height, 12 meters (39.4 feet), made by Blériot in August, 1907, and for distance and duration 2,004 meters (6,575 feet) and 3 minutes and 39 seconds respectively (made on March 21st, 1908—two weeks after the trophy was offered—by Henry Farman). As for carrying a passenger, this had never been done, even by the Wrights in America. So improbable did it seem to the donors that the feat their prize called for could be accomplished, that they allowed a period of ten years in which it could be won.



MM. Renaux and Senouque starting on their 235-mile flight from Paris to the Puy de Dome.

The biplane gliding to the summit of the mountain.

The biplane approaching the Puy de Dome.

The observatory can be plainly seen on top of this 4,813-foot mountain.

The marked advance in aviation in 1909 and the far greater and more rapid progress made last year caused two attempts to be made last summer. One of these—that of the Morane brothers in their Blériot monoplane—resulted in an accident soon after the start owing to a reserve can of gasoline breaking loose and interfering seriously with the steering gear. The monoplane plunged to the ground and the two brothers were both badly injured. The other attempt by Weyman, a young Haitian, in his Henry Farman biplane, was much more successful, Weyman getting within fifteen or twenty miles of his destination but being compelled to descend on account of night setting in after he had lost his way and made several descents *en route* in the fog.

The first of last month Weyman, with his Henry Farman biplane, and Renaux, with a similar Maurice Farman machine, began practising making long glides from heights of 1,000 feet or so, and alighting upon a small marked-off spot. Next they perfected themselves in alighting upon such a spot with a passenger.

On Monday, March 6th, Renaux was ready to attempt the great flight, but weather conditions at the Puy de Dome were not favorable. The next morning, however, word was received that the air was clear, with no wind. As there was only a light and favorable northeast breeze blowing at the aerodrome at Buc, Renaux got out his machine, and climbed aboard with his passenger, M. Senouque. He left the ground after a short run at 8:50 A. M., and flew to the Aero Club park at St. Cloud, where he crossed the starting line at 9:12:34 2/5. Heading straight southward, he flew above the aerodrome of Juvisy at 9:28. Fifty minutes later he passed over the railway station at Montargis, and flew down the line at an elevation of 1,000 feet, overtaking and beating an express train. In another hour he crossed Cosne at high speed, and at 11:30 La Charitié at a height of 600 feet. A quarter of an hour later the machine was sighted by the great crowd that awaited it at Nevers, where Renaux had planned to alight and take on fuel. After circling gracefully about the cathedral of St. Cyr, the aviator alighted upon the aerodrome of the "Lone Poplar" at 11:53:30. His time for this first stage of the journey (141.5 miles) was 2 hours, 40 minutes, 55 3/5 seconds, and his average speed about 52¾ miles an hour. He reported heavy wind gusts near Briare, but the favorable

(Continued on page 330.)

Aviator Philip Parmalee and Lieut. B. D. Foulois flying above the army encampment at San Antonio, Texas, in the army Wright biplane.

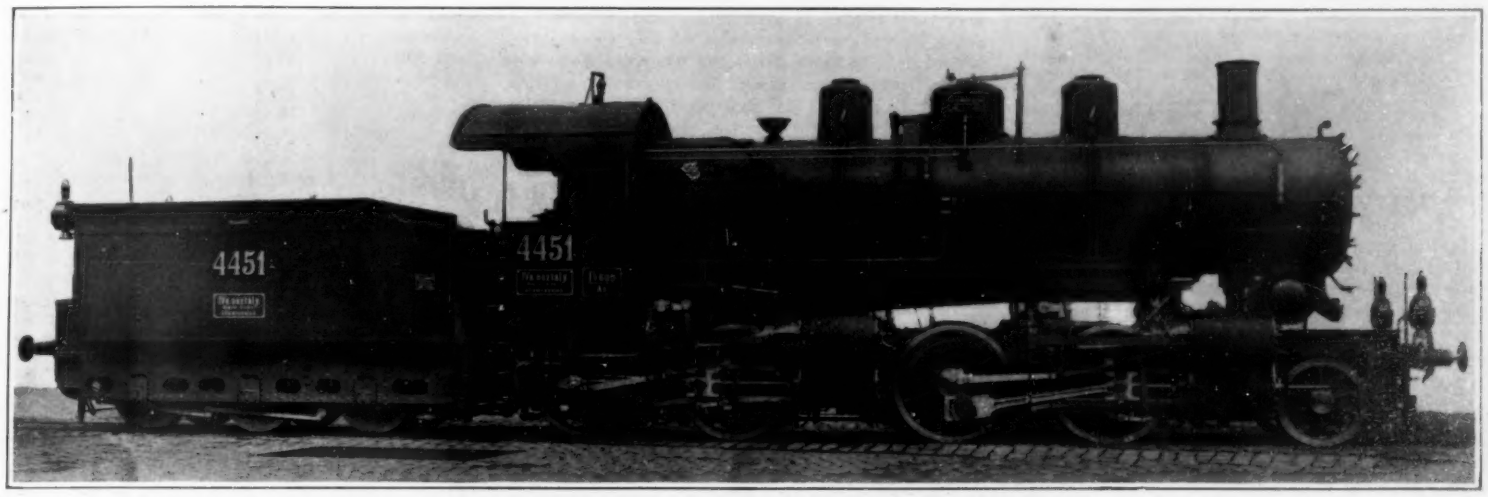
RECORD-BREAKING AEROPLANE FLIGHTS IN FRANCE AND AMERICA

Two Recent European Compound Locomotives

A French and a Hungarian Engine

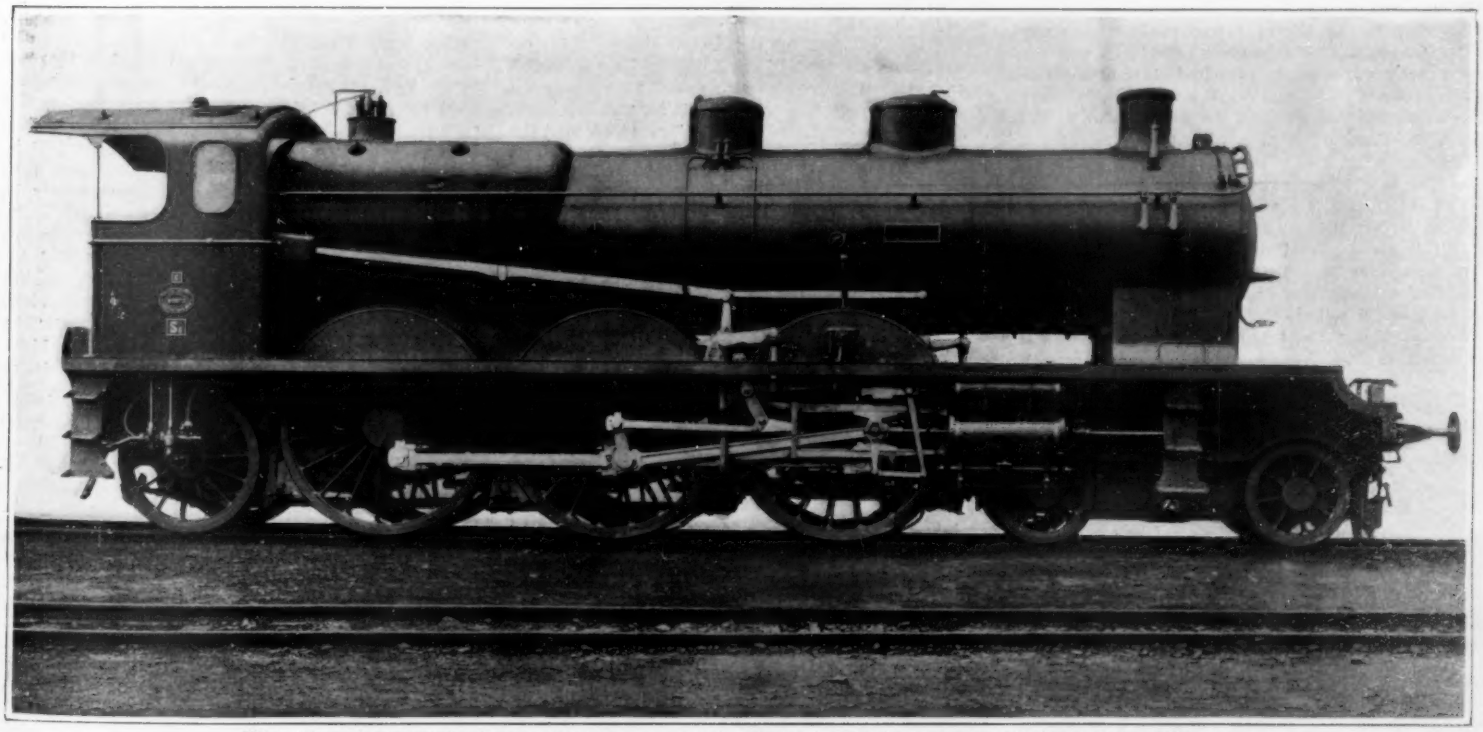
By our London Correspondent

FOR reasons which, even to-day, are not altogether clear, European locomotive builders regard the compound type of locomotive with much more favor than we do in the United States. The trial of the system in this country has shown it to be not well adapted for local conditions. In Europe, it appears to meet conditions in a very satisfactory way—at least, this is the conviction which is forced upon us by the very extended use of the system on the Continent. We present herewith photographs of two of the latest European productions, one a French four-cylinder compound express locomotive, the other a four-cylinder compound freight locomotive, built for service in Hungary.



Although this engine looks like a Mallet it is not articulated. Two distinct sets of engines and driving wheels are carried on a single frame. High-pressure cylinders, 16.4 inches by 25.6 inches; low-pressure cylinders, 25.1 inches by 25.6 inches. Weight, 71 tons. Heating surface, 2,537.4 square feet.

A Hungarian compound locomotive with two sets of engines and driving wheels.



Weight, 82 tons; heating surface, 2,155 square feet; high-pressure cylinders, 15 inches by 24.6 inches; low-pressure cylinders, 23.6 inches by 23.6 inches.

A powerful Pacific type French passenger engine with superheater.

TWO PRODUCTS OF EUROPEAN LOCOMOTIVE SHOPS

The French engine, a well-proportioned design, carried on twelve wheels, was built for the railways of Alsace-Lorraine, by the Société Alsacienne de Constructions Mechaniques. It is provided with a Schmidt smoke tube superheater. Ordinary slide valves are used for the low-pressure cylinders and Schmidt's piston valves for the high-pressure cylinders. Two independent Walschaert gears are employed. The weight of the engine empty is 75 tons, and the total weight in working order is 82 tons. The weight on the truck is 23 tons and the weight on coupled wheels is 48 tons, while that on the trailing wheels is 11 tons. It is of interest to note that the mean diameter of the boiler is 63 inches, and its working pressure is 213 pounds per square inch. The boiler has 92 tubes 2.61/2.76 inches and 24 tubes 4.69 inches in diameter. The heating surface in the firebox is 187.1 square feet, and that of the small tubes is 1,553.6 square feet, while the heating surface of the large tubes is 414.4 square feet. This gives a total of 2,155.1 square feet. The area of the superheater is 414.4 square feet, and the grate area is 34.7 square feet.

The high-pressure cylinders have a diameter of 15 inches and the low-pressure cylinders are 23.6 inches in diameter; the piston stroke is 23.6 inches. The coupled wheels have a diameter of 80.38 inches, and the bogie wheels of 37.43 inches, while the trailing wheels have a diameter of 55.16 inches. The total wheel base of the engine is 33.958 feet, and its total length is 41.669 feet.

The tender empty weighs 21 tons, and the water capacity of the tender is 21 tons, while the coal capacity is 6 tons. This gives a weight of 48 tons in working order for the tender. The diameter of the tender wheels is 3.281 feet.

The compound Hungarian locomotive is not, as at first sight might appear to be the case, of the Mallet type. It employs two sets of driving wheels and two independent sets of cylinders, but each set is attached rigidly to a common frame.

One set is operated by a pair of high-pressure cylinders and the other by a pair of low-pressure cylinders. The engine was designed for drawing heavy loads up grades of a maximum of 2.5 per cent and operating on curves of a moderate radius.

The two high-pressure cylinders measure 16.4 inches in diameter and the low-pressure cylinders 25.1 inches, the stroke in each case being 25.6 inches. The eight driving wheels are 4.72 feet in diameter, and the total draw-bar pull is 12.7 tons. The total length of the engine proper over all is 39.34 feet. It weighs empty 64 tons, and complete with fuel and water ready for operation its weight is 71 tons.

The boiler has a total heating surface of 2,537.4 square feet, of which 146.2 square feet represents the heating surface of the firebox and 2,391.4 square feet that of the tubes, of which there are 272, with an outside diameter of 2.76 inches. The grate area is 36.259 feet, and the boiler supplies steam to the high-pressure cylinder at 225 pounds to the square inch.

Notes on the Planets, Asteroids, and Occultations of April, 1911

By Rev. Ruel W. Roberts

HARDLY anyone would experience any difficulty in finding the bright and attractive planets Jupiter, Saturn and Venus. When visible they outrival all the surrounding stars. Mars is equally bright and attractive at times of opposition, and always visible to the naked eye, even when more distantly located from the earth. Even Mercury can be found without difficulty by merely a naked-eye view if one looks for it at the proper time. This is easily determined by consulting the *Nautical Almanac*, and noting when the planet is at its greatest

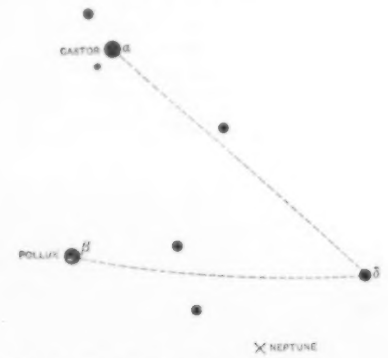


Fig. 1.—Showing location of δ Geminorum.

eastern or western elongation, that is, most distantly situated from the sun in either the evening or morning sky as the case may be. The astronomical notes in the SCIENTIFIC AMERICAN tell this interesting news from month to month, and for the majority will be more convenient and communicative than the technical and abstract *Nautical Almanac*.

This leaves Uranus and Neptune. Uranus is not a difficult object of observation at all, and anyone should be able to pick it up with the aid of only an ordinary pair of opera or field glasses or a small telescope. At times it is fairly manifest to the naked eye if one knows right where to look for it. It is of about the sixth magnitude. Early in December last it was close to *f* Sagittarii, but not well positioned for observation. From February 1st to April 1st, 1911, it will be from two and three-quarters to five degrees and a half to the left of *f* Sagittarii. Hardly any further suggestions need be given other than that one should study carefully the principal stars of the constellation Sagittarius, and work out from the more easily detected ones near, to the desired star *f*, and from it to Uranus. With a high power on even a 3½-inch refractor, I have seen Uranus as a disk.

But the case is somewhat different with Neptune. To find this planet is a somewhat more difficult task, although within the reach of almost anyone if a little help is given. Yet it is strange that so few amateurs have ever picked it up. Even many college professors teaching astronomy have never seen it. Not long ago a college professor in the West, and a really capable one, too, told an amateur that he could not expect to find Neptune, as he had never seen it

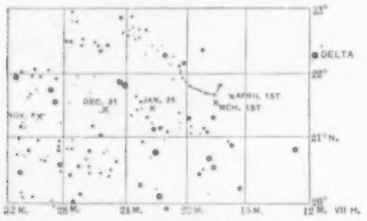


Fig. 2.—x = position of Neptune for given date. Dots show stars down to the 10th magnitude.

himself, though he had a fine six-inch refractor well equipped in a small observatory. He said it was beyond the power of a six-inch. The truth is that at times it can be seen in even a good pair of field or opera glasses. Quite often one reads in some scientific paper or astronomical journal some such sentences as these in giving notes on the planets: "Neptune is beyond the range of all save a good-sized telescope and the aid of an observatory equipment." "Neptune is invisible except in large telescopes." Yet despite this it is an object of about the eighth magnitude, and at times even between the seventh and eighth, and visible in a small two or three inch instrument.

Now 1911 is a very favorable time to look for Neptune, because it is in close proximity to Delta Geminorum, Neptune was practically stationary from October 1st to December 1st. During all this period its entire motion was only about one minute of time —fifteen minutes of arc. On October 25th it was entirely stationary. At this time it was a little over four degrees from Delta Geminorum. It then began to move toward this star, although only slowly at first. In Fig. 2 its position is noted for November 8th and four subsequent dates. On March 30th it was again stationary and at its nearest point to Delta Geminorum. So this is the most favorable time for its study. From this time on it moves away from Delta, and continues to separate itself from that star until November 1st, 1911, when it is again stationary. It resumes its motion again toward Delta until April 1st, 1912, but is not nearly as close as for this year of 1911, and it will not be close to any star visible to the naked eye before November and December, 1912, when it will be very close to 85 Geminorum.

With the aid of the star map in Fig. 2 one can locate it for any of the dates given, or for the intermediate dates by making a due allowance. With the aid of a pair of opera glasses one should study carefully the stars in the field designated. About two degrees to the left of Delta is an interesting group of quite bright stars which form an interesting circular shape. In the figure they are connected by lines to show their shape. In a straight line from Delta and through this group one comes to two small stars, fairly bright and close together. They are about one degree from the star group. Working out from this configuration, and daily studying the area, carefully familiarize yourself with the stars near Neptune. Neptune will manifest itself in a short time by its location and manifest change of position. Sometimes it takes a few days to detect its change, but usually it is manifest within twenty-four to forty-eight hours if it is reasonably close to some other star. Some claim to be able to detect Neptune by its color, a green, but this is a rather difficult if not impossible task, as it is not in strong contrast with the stars about it. One will readily note this to be the case after he has once found it. After one has struck the trail of the planet, there should be little difficulty in following its course from week to week. It will only be necessary to make observations every few evenings.

This same method employed in finding Neptune enabled me to find Halley's comet in a 3½-inch refractor a year ago last November, and may also be employed in finding faint telescopic comets, asteroids, and similar objects, though one has but a small instrument at his disposal.

"There are," says Astronomer Noble, "few more curious, instructive, nay, even startling sights in the heavens than the occultation of a fixed star, or more rarely of a planet, by the moon. When this occurs at the dark limb of our satellite, its suddenness is such as not infrequently to extort an exclamation from the observer who witnesses it for the first time. . . . 'In a moment in the twinkling of an eye,' the star which shone as a brilliant point in the sky is blotted out, and its place seemingly knows it no more until it reappears from behind the opposite or illuminated edge of the moon. After full moon, of course, the eastern limb is illuminated, so that the disappearance takes place at the bright edge, and the star on its reappearance starts instantly from behind the dark limb. Such a fascinating sight should be witnessed by everyone, and so below we furnish the list of occultations for the month of April, so that one can see when to be on the outlook for the phenomena. The magnitudes are given, so that one can judge of the most favorable time for witnessing the sight in a small telescope or pair of opera or field glasses. One should have no difficulty in seeing the occultation of a third or fourth magnitude star in even a small telescope of even one inch aperture or small pair of operas. Any such occultation may be witnessed in a two-inch instrument. The nearer to new moon the time, the finer will be the sight, as the light from the moon is less intense, and so does not dim the star so appreciably.

STARS OCCULTED BY THE MOON.

Of the stars occulted by the moon during April, the five following are the more favorable for observing the beautiful phenomenon described above. The time is given in Washington mean time.

Date.	Name of Star.	Magnitude.	Disappearance. Hr.	Disappearance. Min.	Reappearance. Hr.	Reappearance. Min.
April 3rd	k Tauri	5.6	10	17 P. M.	10	57 P. M.
April 6th	Omega Cancri	6.0	6	19 P. M.	7	34 P. M.
April 12th	Theta Virginis	4.6	8	57 P. M.	10	12 P. M.
April 16th	19 Scorpii	4.9	10	11 P. M.	11	0 P. M.
April 17th	22 Scorpii	4.8	4	52 A. M.	6	5 A. M.

ASTEROIDS FOR APRIL.

Below will be found the ephemeris for Ceres, Juno, and Vesta—the only asteroids an amateur may expect to locate during April. It will be best for the average amateur to center his attention on Juno and Vesta because of their favorable location and proximity to easily detected stars. Ceres is of good magnitude though, and may be picked up by some by carefully studying its location on a star map. It is not, however, very close to any conspicuous star. Let it be carefully noted, though, that on April 28th Juno is very close to Delta Virginis—the R. A. of this star being 12h. 51min., and its Dec. is north 3 deg. 52 min., while on April 28th the R. A. of Juno is 12h. 51min., and its Dec. is north 3 deg. 58 min.; in other words, within six minutes of a degree of Delta Virginis and to the north of it. It is not often so favorable a position is presented. Again, by consulting the ephemeris given below it will be noted that an almost as favorable position of Vesta presents itself late on May 1st or early of May 2nd. It will then be near Epsilon Tauri, whose R. A. is 4h. 23min. and its Dec. is north 18 deg. 59 min. By interpolation of the R. A. of Epsilon Tauri on May 1st or 2nd as stated will be 4h. 23min. and north Dec. 19 deg. 13 min., or about 14min. of arc north of this star. Its magnitude is also favorable.

CERES.

Date.	Mag.	R. A. Hr.	R. A. Min.	Dec. Deg.	Dec. Min.
April 6th	8.93	2	45.8	N. 11	55
April 14th	....	2	58.0	13	6
April 22nd	....	3	10.5	14	14
April 30th	8.97	3	23.3	15	19

JUNO.

Date.	Mag.	R. A. Hr.	R. A. Min.	Dec. Deg.	Dec. Min.
April 6th	9.50	13	8.0	N. 1	28
April 14th	....	13	1.8	2	29
April 22nd	....	12	55.9	3	22
April 28th	....	12	51.6	3	58
April 30th	9.65	12	50.7	4	6

VESTA.

Date.	Mag.	R. A. Hr.	R. A. Min.	Dec. Deg.	Dec. Min.
April 6th	8.53	3	40.5	N. 16	30
April 14th	....	3	53.5	17	25
April 22nd	....	4	6.9	18	16
April 30th	....	4	20.6	19	3
May 8th	8.68	4	34.6	19	45

The Current Supplement

THE splendid article by J. V. Davies on "Handling Passengers on a Rapid Transit Railroad," which was begun in last week's SUPPLEMENT, is concluded in the current SUPPLEMENT, No. 1839.—From the earliest days of photographic astronomy, one of the difficulties to be met and overcome has been the curvature of the field. To correct this, curved photographic plates have been proposed. How they are to be used, Mr. F. A. Bellamy explains clearly.—In view of the potash controversy in which this country and Germany are involved, Mr. W. C. Phalen's authoritative discussion of the subject will be welcomed.—The crane collection of the New York Zoological Park is described and illustrated.—Mr. F. W. Henkel outlines some new theories of the evolution of stellar systems.—A turning point in the history of iron occurred when Bessemer invented his converter. Another turning point has been marked by the introduction of electric furnaces. The whole subject is well handled in an article entitled "The Use of Electricity in the Metallurgy of Iron."—Lieut. Frank P. Lahm ably discusses the relative merits of the dirigible balloon and aeroplane in warfare.

Sugar from Cellulose

THE possibility of obtaining sugar and alcohol from cellulose or woody fiber has often been discussed and several more or less successful experiments in this line have been made. Two German chemists, Ost and Wilkening, have recently described the best conditions for the transformation of cellulose into glucose by sulphuric hydrolysis. The cellulose should be dissolved in 72 per cent sulphuric acid, at the ordinary temperature, in the proportion of 1 part by weight of cellulose to 10 parts of acid. The solution is then diluted with water until the proportion of sulphuric acid is reduced to 3 per cent, heated to 250 deg. F. in an autoclave during one hour, and finally neutralized with calcium carbonate. The solution of glucose thus prepared can either be concentrated for the purpose of obtaining sugar, or subjected to fermentation for the production of alcohol. Almost the theoretical quantity of glucose is obtained, while fermentation produces 83 per cent of the theoretical amount of alcohol.

What do You Think of the Scientific American?

Some Answers to a Question which We Put to Our Readers a Few Weeks Ago

THE full-page advertisement which we published, in which we invited our readers to express themselves frankly about the SCIENTIFIC AMERICAN, *has brought forth an overwhelming response. Some of the letters have been highly eulogistic; some have indicated the very personal views of their writers; and some have been really helpful in pointing out what we must still do to make the* SCIENTIFIC AMERICAN *an even more popular weekly than it was before. The following letters are selected and published largely for the purpose of stimulating more replies.*

The Editor wants you to take the same personal interest in the SCIENTIFIC AMERICAN *that he takes in it himself. After all, it is your paper as much as his. You pay for it, and you have a right to tell him whether or not you are getting what you expect out of its pages. If you have not already communicated with the Editor, do so. Tell him whether or not you agree with the readers whose letters appear on this page; tell him just what the* SCIENTIFIC AMERICAN *means to you, where it helps you, and where it fails to help you.*

A Believer in the New Scientific American

To the Editor of the SCIENTIFIC AMERICAN:

I have been a constant reader of the SCIENTIFIC AMERICAN for twenty-six years that it has been coming into our home, and it is prized above all others to such an extent that we have every number, well preserved, for this period of time.

Transfer the weekly list of patents granted to the SUPPLEMENT, and give us reading matter in its place. All subjects enumerated in the editorial chart are of interest to me, and I would not care to see any of them cut out, especially Notes and Queries and Correspondence.

Shickshinny, Pa. A. W. STACKHOUSE.

The Approval of an Electrician

To the Editor of the SCIENTIFIC AMERICAN:

I think, after considering the tasks involved, you cover the sciences and arts in a remarkable way, but would like to see a series of articles started on elementary astronomy and chemistry. We fellows who have developed only in our own particular vocation, have only a smattering idea of what our brothers are accomplishing, and can hardly realize or appreciate their achievements, because we lack the basic principles, and do not have the time to read over the long drawn out articles as found in the modern text-books. I do not believe such articles would have to be explanatory to any great degree, but simple articles that are to the point.

The innovation you made at the first of the year I think was for the better. Your papers are most interesting and instructive, and I never fail to stop in at the newsstand every Saturday noon for the papers that have precedence over the Sunday newspaper with its accompanying trash.

The weekly list of patents does not interest me to any great degree, and transferring them to the SUPPLEMENT makes no difference, as I read both.

The Notes and Queries are very interesting, and I would like to see them continued.

The naval articles I believe could be less frequent, and their space taken up by steam engineering and gas engines.

York, Pa. J. IRVINE THOMAS, Electrical Specialist.

An Inventor Speaks.

To the Editor of the SCIENTIFIC AMERICAN:

I don't like the idea of your transferring the weekly list of patents granted, to the columns of the SCIENTIFIC AMERICAN SUPPLEMENT, for it interests me very much to see the new inventions every week. I like the Home Laboratory pages, for they have some very interesting articles in them. The Inventor's Department is also very interesting to me.

I think if you could give us a page in every issue on electricity in different forms, and take up the subject of wireless telegraphy and telephone, that it would be greatly appreciated by the majority of your readers.

The aeronautic progress does not interest me very much, for there seem to be too many lives lost.

Your monthly astronomical page does not interest me, while there may be a lot of your readers that it interests more than any other page. I would like you to add a page for great inventors that have made a success in life, showing the difficulties that they met and how they got around them, and the best way they found to handle their patents. I am interested in inventions more than in anything else.

Graham, Mo. J. I. JOHNSTON.

A Cure for Weariness

To the Editor of the SCIENTIFIC AMERICAN:

Please do not omit the list of patents issued, as that feature is very interesting; and to the man who is not able to subscribe for both the SCIENTIFIC AMERICAN and the SUPPLEMENT, the former comes very near filling all requirements.

In its new dress I think the SCIENTIFIC AMERICAN one of the handsomest periodicals published, and if you could know just how worn out I feel on Saturday nights, and how happy I am after supper to read it, and could realize how like wine it is to my soul, then you could understand better what it is to me. My wife says if I retire without reading on Saturday nights, I jump and jerk like one with St. Vitus's dance—that is not rocking the baby to sleep, but it states a fact as to me.

Let me add that I occasionally use it to good advantage as a counterbalance with some of my clerical friends; for instance, there was a strong letter written the *Age-Herald* here for its Sunday issue some time back, relative to the manufacture of matches. I sent Dr. Eaves, the author, who is the Congregationalist minister here, a copy containing the article on the use of white phosphorus, for which enlightenment he thanked me. He found one corporation had a soul!

Birmingham, Ala. E. Z. CROW.

One Who Approves

To the Editor of the SCIENTIFIC AMERICAN:

I have taken and read your paper since 1867, and attribute a good share of my success to the very instructive articles contained in its columns.

The SUPPLEMENT seems to me to be the home of the weekly list of patents granted.

In fact, I cannot suggest how you could improve your paper. You are all right now.

Calais, Me. F. N. DAVIS.

More Archaeology Wanted

To the Editor of the SCIENTIFIC AMERICAN:

I have been a constant subscriber and reader for thirty-eight or thirty-nine years, am not sure which. Is not that a sufficient answer? I take four other scientific journals. If I have to give up any of them, the other four will go first.

I am glad that you can enlarge the paper, and also can give us the monthly magazine feature; and I am specially pleased with the new department you have added—"Science in the Current Periodicals." That gives a variety from other authors. The articles in the last two issues under that department about "New Stars," "Origin of Nebulæ," and "The Universe a Mechanism," were intensely interesting and instructive.

I do not read everything in the paper. I never read the List of Patents. But I do not wish to suggest leaving out anything, for fear it may be the very thing that interests some other reader. My "hobbies" are astronomy, geology, and evolution. You cannot give me too much about astronomy.

If convenient, let us know more about archæology—tell us the news from the explorers in Egypt and Babylonia; what new things they are discovering.

I like the Science, Engineering, and Electricity columns, and be sure to keep up the Notes and Queries, which have always interested me.

Coldwater, Mich. C. W. BENNETT.

A Smile and a Frown

To the Editor of the SCIENTIFIC AMERICAN:

I have been a constant subscriber to the SCIENTIFIC AMERICAN for the past eleven years. I receive the paper on Saturday night or Sunday. I first look through it to see what the illustrations are. Then I turn back to the editorial page, and read the whole paper. It may be that I do not finish it before the next one comes, but I am sure to read all the reading matter and many of the advertisements before I file it away.

The way you have kept your readers informed on the construction of the Panama Canal, on the growth and improvement of the navies of the world, on the improvement of aeronautics and the automobile, on the new and useful methods of structural steel and concrete, are commendable, and I assure you are very much appreciated by your readers.

As to transferring the weekly lists from the SCIENTIFIC AMERICAN to the SUPPLEMENT, I miss them badly, yet must confess that I rarely ever read them. The usefulness to me was to watch for something to come out that would be to my interest.

If I have any objections to the SCIENTIFIC AMERICAN, they are that in giving measurements they are often given in French; and while I may be very much interested in the article, possibly the most important part of it, I do not understand.

As to the editorials, I can truly say that the most masterful, deeply thought out, comprehensive worded articles that I ever read are to be found on the editorial pages of the SCIENTIFIC AMERICAN.

Brownwood, Tex. P. L. HOWLETT.

What a Brother Editor Thinks

To the Editor of the SCIENTIFIC AMERICAN:

It makes a man sit up to see an idea flashed around the world, the execution of which he has been revolving in his own mind. I refer to page 262 of your issue of March 11th.

I had been considering identically this same idea, as applied to our January and February issues. That is, summarizing our editorial features during those two months to show people just what we were doing in the way of instructive and useful information to the trade we represent.

I compliment the SCIENTIFIC AMERICAN on the apparent improvement. Although I am not directly interested in a business way in mechanics and engineering, nevertheless the clear presentation and the able and interesting treatment of mechanical devices and scientific improvements have been such that for twenty-five years I have occasionally bought a copy and read it carefully, merely in the way of adding to my general knowledge of the practical things that were developing in this greatest of inventive and manufacturing nations as well as abroad.

Here is a point that you may consider worth publishing or referring to in some way: For a longer period than the one above mentioned, I have always felt a sympathetic appreciation of a device which facilitated any operation or which seemed to meet the traditional "long-felt want." I believe I never yet was introduced to a handy, compact, ingenious, or useful device for facilitating any operation, from apple paring to dredging machines, or from lamp burners to cigar trimmers, that I was not surprised to see the date of the patent on it. Every time I have seen patented affairs, concerning which I would exclaim, as would everybody else: "The very thing; just what I have been looking for! I wonder somebody did not invent that long ago! It certainly fills the bill and will be popular." Then upon glancing at the date of the patent I have been greatly surprised to find that it had been on the market for years.

The application of this observation is here: It is not enough to have an ingenious, mechanical idea and to have it put into working form and duly patented; the next thing is to introduce it, to get it before the public, and get it into the hands of the people who will welcome it and who have been waiting for it all their lives.

Abstract ideas do not force themselves in this world. Principles are intrinsically inert. It takes force and energy and driving power to get them adopted. Supplying this need I presume is one of the functions of the SCIENTIFIC AMERICAN. It certainly is a most important function; for the inventor of a useful article, it is presumed, is not working solely for posterity; he wants some return for his invention before he and the patent both expire.

WALTER C. TAYLOR,
Boston, Mass. Editor of *Boot and Shoe Recorder*.

From a Canadian Reader

To the Editor of the SCIENTIFIC AMERICAN:

The Handy Man's Workshop is better once a month than twice. The transferring of the patent list to the SUPPLEMENT was a good move, as the literature supplied in its place is of more value. Now astronomy, electricity, chemistry, and physics interest me most. The first two have received a fair proportion, but I think that chemistry and physics have been slighted, chemistry especially. Aeronautics have been much to the fore, about 300 out of 2,000 columns. Now that the first great interest is over, I think we can get along with less.

Thanking you for this opportunity, and wishing you continued success.

W. KENNEDY.
Neepawa, Man.

The Opinion of a Woman

To the Editor of the SCIENTIFIC AMERICAN:

"Sit down and write," you say; and so I needs must, although I have to confess I am neither doctor, lawyer, business man, nor an inventor, only just a plain little gray-haired old lady, who has always been interested in the wonderful things which are being made, and the wonderful things which are being accomplished, by the brains and labor of the favored ones in the world. I say favored because they can accomplish what seem almost the miraculous work of the gods, instead of men.

As you have called for criticism, and it is the privilege of elderly women to find fault, also the wounds of friends are faithful, I should be glad to exercise my prerogative, and be able to speak of some defect in the SCIENTIFIC AMERICAN, but even with my glasses on I can give only words of approval. It comes to us every week, bringing us the latest news of what has been wrought in the great field of scientific research, telling us of the wonderful inventions, and even of the little thoughts which are either very useful, or such simple improvements of every-day utensils, that we just wonder that we did not think of them ourselves; then giving glimpses of the starry sky, and making us familiar with those constant and wonderful companions.

Surely there is no part of the paper that we want to miss, although my untrained woman's brain can only admire, and wonder sometimes, without quite understanding the different valves, hinges, and coils in their several offices. Those I pass over, content that there are wiser heads than mine, and that the huge machines will certainly do the work assigned to them.

I wish there were more women inventors, but am always proud, although almost envious, when there are found any who have thought out better ways of doing things.

Pittsfield, Mass. MRS. O. S. HOUGHTON.

Science in the Current Periodicals and Books

In this Department the Reader will find Brief Abstracts of Interesting Articles Appearing in Contemporary Periodicals at Home and Abroad

The Sea Kings of Crete*

PROMINENT among the difficulties which have in the past attended investigations of the earlier Grecian records has been that of accurately defining the point where legend ceases, and where authentic history begins. In dealing with this subject it has been necessary to take into account the influence exercised upon the earlier historians by the stories which they had been accustomed to treat with reverent appreciation.

With the development of modern intellectual progress, this difficulty became more apparent, until its solution was facilitated by the mute evidences of past ages. This idea guided the steps of Schliemann and other Hellenic explorers, who would not believe that the monuments of ancient civilization had vanished from existence, but claimed that they could be disinterred. The success of Schliemann's work at Troy gave the needed impetus to the labor of his colleagues in other fields, who may justly be regarded as having been guided by his spirit in their concurrent and subsequent explorations.

In the assumption that ancient culture was more or less generally diffused, explorers in other Hellenic fields displayed marked activity. In this connection special interest attaches to the researches carried out in the island of Crete, where the arts of civilization had at an early date attained a high stage of development.

What Schuchardt did to record Schliemann's work at Troy has been successfully accomplished with regard to Crete in the interesting work before us.

This volume,* replete with valuable material, defines in lucid terms the connection between the old traditional legends and the discoveries brought to light by recent excavations. By the author's graphic and minute descriptions the palaces and other surroundings of Minos and his successors are vividly reproduced; while the manner in which the "finds" of antique pottery, metal work and other forms of decorative art have been described, imparts reality and distinctiveness to the narrative of Crete's ancient civilization.

In a work of this kind close acquaintance with existing authorities on the subject is a primary requirement, and in this respect the author has proved himself an accurate investigator presenting divergent opinions under their various aspects in a thoroughly impartial manner.

THE LEGENDS.

The resurrection of the prehistoric age of Greece, and the disclosure of the astonishing standard of civilization which had been attained on the mainland and in the isles of the Aegean at a period at least 2,000 years earlier than that at which Greek history, as hitherto understood, begins, may be reckoned as among the most interesting results of modern research into the relics of the life of past ages. The present generation has witnessed remarkable discoveries in Mesopotamia and in Egypt, but neither Nippur nor Abydos disclosed a world so entirely new and unexpected as that which has been revealed by the work of Schliemann and his successors at Troy, Mycenæ, and Tiryns, and by that of Evans and the other explorers—Italian, British, and American—in Crete. The Mesopotamian and Egyptian discoveries traced back a little farther streams which had already been followed far up their course; those of Schliemann and Evans revealed the reality of one which, so to speak, had hitherto been believed to flow only through the dreamland of legend. But the legends were manifestly largely imaginative, and it seemed impossible that we should ever get back to the solid ground, if solid ground had ever existed, on which these ancient stories first rested. What proportion of fact, if any, lay in the stories of Minos, the great law giver, and his war fleet, and his Labyrinth, with its monstrous occupant; of Theseus and Ariadne and the Minotaur; of Dædalus, the first aeronaut, and his wonderful works of art and science; or of any other of the thousand and one beautiful or tragic romances of ancient Hellas—to attempt to determine this lay utterly beyond the sphere of the serious historian.

Within the last forty years all this has been changed. All preconceived ideas may be upset by the results of a single season's spade work on some ancient site. The work, of course, is by no means complete; but already the dark gulf of time that lay behind the Dorian conquest is beginning to yield up the unquestionable evidences of a great and splendid and almost incredibly ancient civilization. In this remarkable resurrection of the past the most important and convincing part has been played by the evidence from Crete; but it was not until the treasures of Knossos and Phæstos began to be revealed in 1900 that it became manifest that what was known as the Mycenæan civilization was only the decadence of a far richer and fuller culture, whose fountain-head and whose chief sphere of development had been in Crete.

The first task, therefore, is to gather together the main features of what the ancient legends of Greece narrated about Crete and its inhabitants and their relations to the rest of the Aegean world. It is round Minos, the son of Zeus and Europa, that the bulk of the Cretan legends gathers. According to the story, Minos is not only the son, but also the "gossip" of Zeus. He receives, like another Moses, the code of laws; he holds frequent and familiar intercourse with Zeus. Finally, at the close of his life, he is transferred to the underworld, and the great human law giver becomes the judge of the dead in Hades.

This is one side of the Minos legend, but the Minos who is most familiar to us in Greek story is the great sea king and tyrant, whose vengeance was defeated by the bravery of the Athenian hero, Theseus. When his own son fell a victim to the suspicion of Aegeus, the King of Athens, Minos raised a great fleet and levied war upon Athens; and he at length reduced Attica to such straits that King Aegeus and his Athenians were glad to submit to the hard terms which were asked of them.

Such, then, are the most familiar of the legends and traditions associated with prehistoric Crete.

THE HOMERIC CIVILIZATION.

Between the Greece of such legends as we have been considering and the Greece of the earliest historic period there has always been a great gulf of darkness. It seemed as though the marvelous fabric of Greek civilization as we know it was indeed something unexampled, rising almost at once out of nothing to its height of splendor.

The Homeric poems shone like a beacon light across the dark gulf which separated the Hellas of myth from the Hellas of history, testifying to a splendor that had been before the darkness, and prophesying of a grandeur that should be when the darkness had passed. But perhaps the most striking feature of the setting of the Homeric story is the type of material civilization which is described in the poems. We are confronted with a society not by any means in a primitive stage of development, but, on the contrary, far advanced in the professions of peace and capable of the highest achievements in art and architecture.

SCHLIEMANN AND HIS WORK.

The man whose labors were to give a new impetus to the study of Greek origins, and to be the beginning of the revelation of an unknown world of ancient days, was born on January 6th, 1822, at Neu Buckow, in Mecklenburg-Schwerin. He was the son of a clergyman who himself had a deep love for the great tales of antiquity, for his son has told how his father often vividly narrated the stories of the destruction of Pompeii and Herculaneum, and of the Trojan war. The destruction of Troy and the flight of Aeneas roused in him a passionate desire to see for himself what remained of the ancient splendors of Ilium. By 1858 he considered that the fortune he had made in business was sufficient to warrant his devoting himself entirely to archæology. He finally in 1863 took up the task which was to occupy the remainder of his busy life. Had he been spared for but a year or two longer (than 1890), he could not have failed to complete his work and to prove, as his fellow worker did, that on the site which he had from the first contended to be that of Troy, there had stood a large and splendidly built city, which assuredly belongs to the period of the Trojan war. Schliemann's discoveries were the result of vast, laborious researches, and created an extraordinary amount of interest. It was felt that he had brought the world face to face with facts which would profoundly modify all opinions hitherto held as to the origins of Greek civilization.

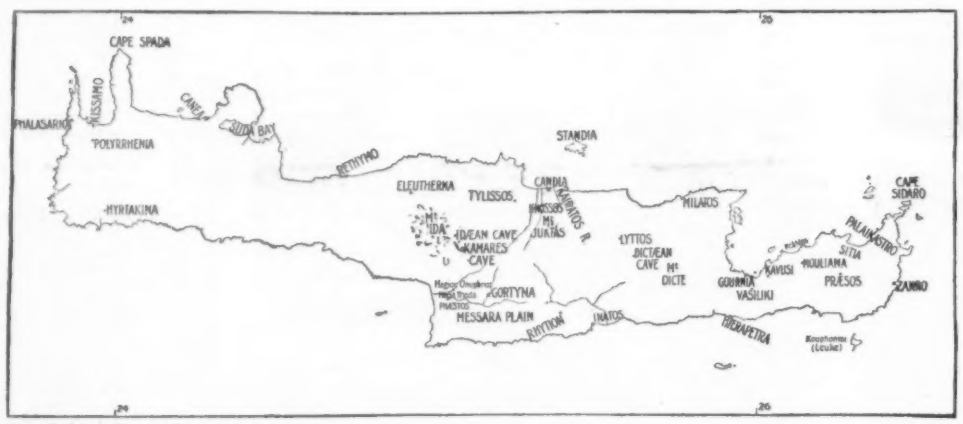
Even before the end of the nineteenth century it became apparent that Crete was destined to prove a focus of this early culture, and the promise has been more than fulfilled.

THE PALACE OF "BROAD KNOSSOS."

In the revival of interest in the origins of Greek civilization it was manifest that Crete could not long be left out of account, for the traditions of Minos and his laws, and of the wonderful works of Dædalus pointed clearly to the fact that the great island must have been an early seat of learning and art. Most of these traditions clustered round Knossos, the famous capital of Minos, where once stood the Labyrinth, and near to which was Mount Juktas, the traditional burying place of Zeus.

The attention of Schliemann and Stillman had been drawn to a hill called "Kephala," overlooking the ancient site of Knossos, but up to the year 1895, when Dr. A. J. Evans secured a quarter of the Kephala site from one of the joint proprietors, nothing of any real moment had been accomplished. In the beginning of 1900 Dr. Evans was at last able to secure the remainder of the site, and on March 23rd in that year excavation began, and was carried on with a staff of from 80 to 150 men until the beginning of June. By the end of the nine weeks' campaign of exploration about two acres of a vast prehistoric building had been unearthed.

In a passage-way there came to light one of the first fairly complete evidences of the outward fashion and appearance of the great prehistoric race which had founded the civilization of Knossos and Mycenæ. This was the fresco painting, almost perfectly preserved. The block of buildings between the west and the central courts was divided in two by a long gallery. Between this gallery and the western wall of the palace lay a long range of what had evidently been magazines for the storage of oil, and perhaps of corn. They were occupied by rows of huge earthenware jars, or pithoi, sufficiently large to have held the forty thieves, or to have accommodated the soldiers of Tahuti in their venture on Joppa. Down the center line of each magazine ran a row of small square openings in the floor —"kaselles," as they came to be called.



From Baikie's "The Sea Kings of Crete."

A SKETCH MAP OF CRETE

* "Sea Kings of Crete," by Rev. James Baikie, F.R.A.S. With 32 full page illustrations from photographs. Octavo; pp. 14 + 274, New York, 1910. The Macmillan Company.

"There can be little doubt," says Dr. Evans, "that this vast edifice, which, in a broad historic sense we are justified in calling the 'Palace of Minos,' is one and the same as the traditional 'Labyrinth.' Its bewildering system of small chambers, does, in fact, present many of the characteristics of a maze."

The discovery of the very throne of Minos, for such we may fairly term it, was surely the most dramatic and fitting recompense for the explorer's patience and persistence. No more ancient throne exists in Europe, or probably in the world, and none whose association are anything like so full of interest.

But the discovery which will doubtless prove in the end to be of greater importance than any other was that of large numbers of clay tablets incised with inscriptions in the unknown script of the Minoans. As yet, in spite of all efforts, it has not proved possible to decipher the inscriptions, but there may yet come to light some treaty between Crete and Egypt, which may enable us to read the original records of this long forgotten kingdom.

The important discoveries of 1900 were evidently far from having exhausted the hidden treasures of the House of Minos. Among the other treasures recovered (in 1901) was a quantity of fine painted pottery. Some of the fragments were of that early polychrome style known as "Kamares ware." Of the later pottery of Knossos, which substituted naturalistic motives, executed in monochrome, many specimens were also found.

Most surprising of all, however, in many respects, was the revelation of the amazingly complete system of drainage with which the palace was provided. Indeed, the hydraulic science of the Minoan architects is altogether wonderful in the completeness with which it provided for even the smallest details. Those who remember the many extant descriptions of sanitary arrangements will best appreciate the care and forethought with which the Minoan architects, more than 3,000 years earlier, had provided for the sanitation of the great Palace of Minos.

These, in brief, are the results of the excavation of the ancient palace of the Cretan Sea Kings, so far as it has proceeded. Of the wealth of material which has been brought to light, much still waits for interpretation. The interpretation and co-ordination of the immense body of material gathered by Dr. Evans must for long be the work of scholars.

PHÆSTOS, HAGIA TRIADA, AND EASTERN CRETE.

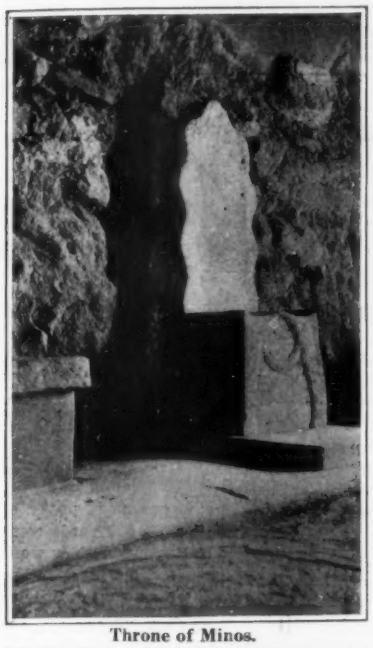
The excavations at Knossos are very far from being the only important investigations carried on in the island of Crete. It would still have been possible, from the results of the excavations made at other sites, to deduce the conclusion which has been arrived at as to the supreme position of Crete in the early Aegean civilization. Both in the Iliad and the Odyssey, Phæstos is mentioned along with Knossos as one of the chief towns of Crete, and it is at and near Phæstos that the most extensive and important remains of Minoan culture have been discovered, apart from the work at Knossos. The result of the work carried on has been the revelation of a palace, similar in many respects to the House of Minos at Knossos.

But as contrasted with the sister palace, the stately building at Phæstos has exhibited a most extraordinary dearth of the objects of art which formed so great a part of the treasures of Knossos. The hill of Hagia Triada, about two miles to the northwest of Phæstos, proved, however, sufficiently fruitful to compensate for the incomprehensible barrenness of Phæstos. The artists of the time worked not only in the precious metals, but also in stone. One of the Hagia Triada finds is a limestone sarcophagus covered with plaster, on which various funerary ceremonies are painted. At Palaikastro, another town, a space of more than 400 by 350 feet has been revealed.

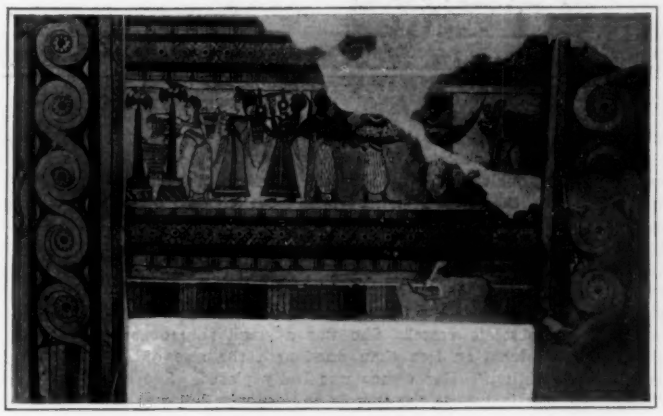
LETTERS AND RELIGION.

As to form of worship, the most striking feature is the seemingly total absence of what we should call temples. The reason of this appears to be that the Minoan religion was of an entirely domestic character.

Such, then, was the empire of the Minoan Sea Kings as it has been revealed to us by the excavations and researches of the last ten years. Perhaps the most striking and interesting result that has been attained is the remarkable confirmation given to the broad outlines of those traditions about Crete which have survived in the legends and in the narratives of the Greek historians.



Throne of Minos.



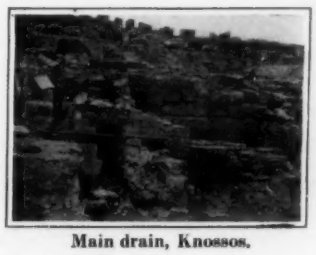
Sarcophagus from Hagia Triada

A magazine with jars and kaselles, Knossos.

Clay tablet and linear script, Knossos.

Minoan pottery.

Terra cotta drain pipes.



Main drain, Knossos.

Great jar with papyrus reliefs.

Fr. a Baikie's "The Sea Kings of Crete."

REMARKABLE CRETAN RELICS

An Automatic Humidifier for Workshops

RECENT investigations in industrial hygiene have shown the importance of maintaining, by natural or artificial means, a moderate and constant degree of humidity in the atmosphere of factories and workshops, but the problem is difficult and most of the proposed solutions are imperfect. The simplest and most obvious process, the admission of steam into the room, causes wood to rot and metal to rust, besides seriously inconveniencing the occupants. This defective and expensive method has now been abandoned and the required moisture is commonly supplied in the form of a spray, the fineness of which must be very carefully regulated. If the drop are too small they evaporate too rapidly in a dry hot atmosphere, and if they are too large they produce a sort of rain in a cool room. It is, furthermore, very difficult to distribute the mist formed by the spray throughout a large room, so as to produce uniform humidity.

The French journal, *Cosmos*, calls attention to an automatic apparatus by an American inventor, J. W. Fries, in which the quantity of spray, or mist, produced is regulated in exact accordance with the hygrometric state of the air, by means of the warping of a ring of hygroscopic wood. The moisture, thus precisely adjusted to the condition of the air, is carried into and through the room by a powerful blast of air.

Sinking a Battleship at Six Miles

The "San Marcos" ("Texas") Under Fire

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THE policy of using old battleships as targets is not a new one; but the conditions under which the recent sinking of the "San Marcos" (formerly "Texas") by the "New Hampshire" was accomplished were so novel as to give this experiment a value which the earlier tests in the British and French navies did not have. The most striking feature was the great range at which the firing was done, the distance between the "New Hampshire" and the "San Marcos" varying from five to as far as six and a half miles for the 12 and 8-inch guns, and from four and a half to five and a half miles for the 7 inch. The accuracy of the fire, even at the greatest range, was surprising, and served to show that the methods of finding and holding the target, at present in use in our navy, are very efficient. Fire control was directed from the top of the military masts, one hundred and twenty feet above the sea, and the target was found by the new system of trial shots and "spotting." In this method a trial shot is fired at the estimated range. The officers on the lofty fire-control platform observe through their powerful glasses the splash as the projectile strikes the water. If the splash is beyond the vessel the elevation of the gun is lowered; if it falls short, the elevation is raised. Thus, by trial and error, the exact range is found.

The "San Marcos," of course, is an old ship, and her 12-inch armor does not compare in resistance with our later cemented Krupp armor; but the fact that at these great distances the ship should have been found and sunk within a comparatively short time, and this by a pattern of 12-inch gun which is inferior in power to the latest type, has given great satisfaction in the navy.

The real interest and value of the experiment, however, will be found in the examination of the ship itself, and the determination of the actual damage done by the various types of projectiles. The matter of the penetration of the armor belt and the turret is only one of several questions of importance. As far as possible, the ship was placed in actual fighting condition, even to the point of having steam up and fire under the boilers. The test of the efficiency of the protective deck alone will probably be worth the expense and trouble of the experiment. Because of the great range, the projectiles, especially from the 8-inch guns, must have fallen at a considerable vertical angle of impact, and presumably the protective deck was severely tried.

At the same time it would be easy to draw too strong conclusions from the quick havoc wrought on this obsolete vessel. She was a small ship of only 6,315 tons, or less than one-fourth the size of our "Wyoming." Her armor was badly placed. She had twelve inches on the turrets and redoubt, but was unprotected on the deck below. Her 12-inch belt covered one-half of the waterline; beyond the belt was merely a 3-inch protective deck.

But after all said and done, the photographs tell a dramatic story of the havoc wrought by the 12, 8, and 7-inch 45-caliber rifles of the "New Hampshire." The most significant result was that obtained when a 12-inch shell (presumably a high explosive) pierced the conning tower; burst and blew one side of the tower, weighing surely 15 to 20 tons, entirely away, hurling it to the main deck below. The same shot entirely wrecked the bridge. The chart house and navigating bridge was blown completely away, and with it must have gone steering wheel, compass, voice tubes, telegraphs and every means of navigating the ship.

Below we append extracts from a statement issued by the Secretary of the Navy, which is full of thrilling interest:

"The 'New Hampshire' placed the salvos anywhere she wanted, and when the gunners wished to have some hits on the conning tower and the turret armor in order to observe the effect they had no trouble placing the shots at from ten to twelve thousand yards range at just the point desired.

"A few projectiles were directed against the masts, so as to show what would happen to the exposed communication systems.

"An inspection of the vessel after the firing showed immense holes which had been ploughed through from one side to the other, many of them being below water and any one or two of them being sufficient to make the vessel a total loss. The armor of this vessel was unable to withstand the impact at the very great range at which we fired, and the battleship was a total loss after the first two salvos were directed at her.

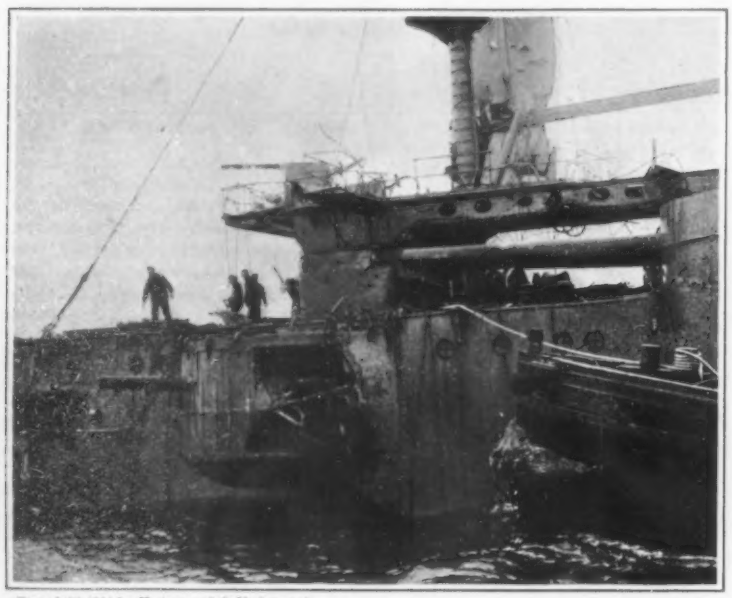
"All the officers of the fleet were deeply impressed with the accuracy and the great destructive effect of the projectiles. All the manikins which were placed at the guns representing the crews were dreadfully cut to pieces, and the fumes and fire left by the passage of high explosive projectiles would have destroyed every living thing. The bulkheads in places were like sieves due to the action of high explosives, and all the compartments below were completely riddled.

"It was remarkable to note the enormous power of some of these projectiles, which at 12,000 yards went through the heaviest armor and continued their work of destruction inside of the vessel. This practice has demonstrated beyond doubt the immense value of the long range firing we have been having for the last two years, and shows that our methods of training are positively the best.

"There was no doubt that the 'Texas' was a total loss very shortly after the firing began, and all hopes of raising her were given up. There are a dozen places where holes from four to six feet in diameter go right through from side to side, cutting away decks, beams, bulkheads, stanchions and armor as if they had been made of paper.

"The under water hits, of which there were a great many, did the most damage, and the fact that the vessel sank at the second salvo of high explosive projectiles prevented many fires that would otherwise have been started. As it was we had a roaring furnace on the gun deck in two different places and in the conning tower, which the two fire tugs got under control after an hour's effort.

"The upper works were absolutely riddled. There was not a single halyard or a means of communication



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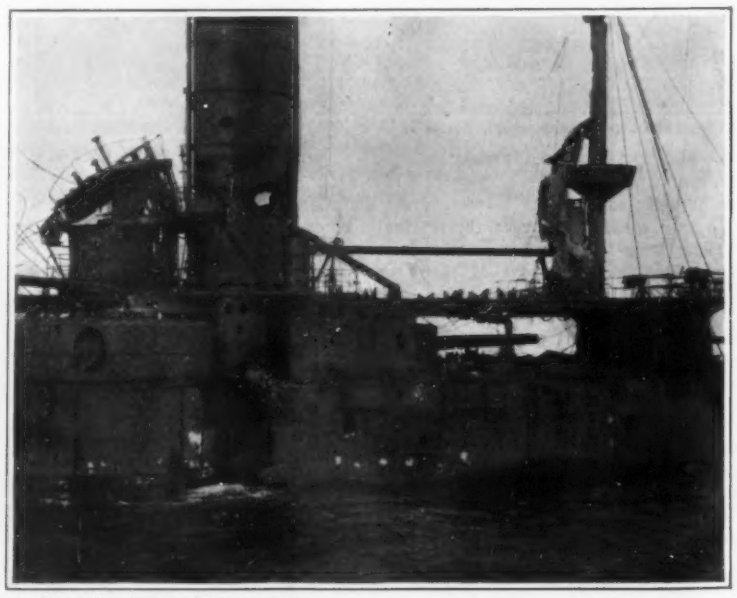
Lee side. The after bridge and a 6-inch gun with portion of sponson blown outboard.



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Weather side. Group of 12-inch shot holes below 12-inch gun turret with sea breaking into the ship. Note that muzzle of the gun is smashed.

SINKING A BATTLESHIP AT SIX MILES

left. The chart house was a mass of splinters after the first projectile, and the decks were cut through as if an enormous pair of shears had done the work.

"One or two salvos from any one of our dreadnoughts will accomplish the same destruction. Of the salvos which were actually directed at the target the percentage of hits at that great range was away beyond expectation. The spotters have for the first time gained the necessary information which cannot be learned by firing against anything but a real vessel."

Too much praise cannot be given to the navy for the admirable results above recorded. They have been rendered possible, only by the co-ordination of the various departments that have been concerned in the design of the ships, the guns and their mounts, the powder and the shells with their delicate fuses, and in the training of the gunners who have shown such deadly accuracy at unprecedentedly long ranges.

The American people have heard much of late years about the excellence of our target practice. Thanks to the camera, they can now judge for themselves.

Internal-combustion Engines for Industrial Power in the Southern States

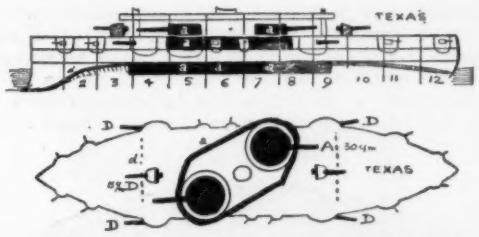
By T. C. Butler, Jr.

IN the South, which is already claiming the attention of the world by reason of its varied and rapid development, the internal-combustion engine is rapidly climbing into a high position in the industrial field. Large power companies, who of necessity have to reduce their power-producing to a basis of hard dollars and cents, have found that for both the steady grind of all night and all day service and for the sudden additions of power required for emergency service, the internal-combustion engine saves dollars every time it turns a wheel.

At the Davis Street power station of the Georgia Railway and Electric Company in Atlanta, Georgia, the Snow Steam Pump Works have recently completed the erection of a three-thousand-horse-power gas engine, which, at the time of its completion, was the largest single unit of its type in the world. The machine was such a success, however, that it was immediately accepted as a type, and has since been erected in somewhat larger units in different parts of the country.

This machine has four cylinders, connected in tandem, two to a side, and looks very much like the ordinary double tandem steam engine usually seen in power houses. The cranks are hung on quarters, which is also according to steam engine practice. The piston rod runs in one continuous piece from the cross-head clear back to the tail end of the last cylinder, where it is supported by a slide rest to help take up the enormous weight of the sliding mass. This piston rod is hollow throughout its length, and a stream of water is kept constantly running through it in order to keep it cool. It slides through stuffing boxes of the ordinary steam engine type, into the cylinders. A man can stand erect in the bore of these giant cylinders; they are all of the four-cycle principle, and are arranged and contrived so as to get an explosion in each end of each cylinder, i. e., double acting, just as a steam engine. With all four cylinders double acting, each rod is constantly receiving an impulse, whether it be pushing or pulling the crank, and with the cranks hung on quarters just as in steam engine practice, the effect of this continuous torque on the crank-shaft—as noted in the steady motion of the engine—is truly remarkable. The speed of the engine is anywhere from 180 to 240 revolutions per minute. It is wonderful and marvelous to stand and watch this giant creation of man operating in its slow, majestic rhythm, and to realize that it derives this easy motion from the violent explosion of combustible gases. It is an engineering triumph, and a commercial and economic success, a striking monument to the prowess of man over the elements.

As a bit of evidence that this class of power is not being confined to large units, it is interesting to note that there is coming into popular use among the oil mills and fertilizer plants springing up all over the South, a very compact form of three-cylinder, vertical, four-cycle internal-combustion engine, which is operated on various forms of fuel—such as producer gas, natural gas, gasoline, kerosene, benzine, naphtha, alcohol, and distillate, in fact, any fuel that will evaporate or can be made to evaporate. The conventional form of this engine has cylinders with eleven-inch bore and thirteen-inch stroke, runs at about 280 revolutions per minute, and at this speed develops 100 horse-power or 65 horse-power, with three cylinders, or two cylinders, respectively. These fertilizer mills generally need power only so there is no fire or furnace of any kind on the premises, and the engines burn liquid fuel; while the cotton-seed oil mills are required to have heat for the process of baking the oil out of the seeds, and as the necessity for buying coal is already existing, they run these engines on producer gas, which is made in a simple type of gas producer right on the premises. This type of power is proving a boon to these industries, and provides cheap and abundant power at intermittent seasons of the year without the necessity of erecting costly steam plants.



Armor plan of the "San Marcos." The turrets, redoubt below, and the belt are protected by old 12-inch steel-faced armor.

Commercial transportation is also feeling the quickening impulse of individually-powered carriers and internal-combustion engines. Several years ago the General Electric Company placed in service on the lines of the Southern Railway Company between Anderson and Greenville, South Carolina, a splendidly-developed type of gasoline passenger car. These cars are shaped like a boat in general outline, with very sharp prow and rounded stern, while the roof is rounded and tapered at both ends, just like the outlines of a boat's bottom. This is to decrease wind resistance, and was adopted after careful tests had revealed the material worth of the design. The radiator, a collection of staggered tubes equipped with radiating fins, rises in a graceful loop over the roof of the car, about four-fifths of the distance forward. The engine has eight cylinders of eight-inch bore and eight-inch stroke, arranged in V-form, like the Curtiss aeroplane engines, four cylinders in a row, all connected to the same crankshaft, the two rows of four cylinders each, being inclined at an angle of 60 degrees from each other. All valves on one side, the inside one worked by one big camshaft which is in between the two rows of cylinders. Ignition is by means of high tension magneto and a conventional form of automobile spark plug; the engine has never been troubled with faulty ignition. Starting is by compressed air, furnished by direct-connected pump having an automatic throw-off valve, which throws the pump out of operation, when the desired pressure is attained; this, also, is fully reliable.

The transmission is believed to be absolutely unique, and has proven very effective and practical. Directly connected to the front end of the crank-shaft is a differentially-wound dynamo, and this is wired to a differentially-wound motor, which is in turn connected by spur gears to the axle of one pair of wheels in the front truck. Transmission is thus by electric current to the wheels. The engine normally operates at a fairly even speed, and is always started revolving by compressed air, when the resistance is cut out of the fields of the dynamo on the crank-shaft, i. e., the dynamo is idle and imposes no load on the engine. The car is then started moving by cutting in this field-resistance into the dynamo, and the stronger the resistance is made, the more current is generated and conveyed to the motor on the axle. Thus the speed of the car is gradually controlled from nothing or idleness, up to a full percentage of transmission of power between the dynamo and the motor, until the motor is making revolution for revolution with the dynamo and the crank-shaft of the engine (less, possibly, a little loss of electrical efficiency). This makes the ideal form of clutch for so heavy a mechanism. After the car is started in motion, the throttle of the engine is used for controlling speed. The engine is very sensitive in this method of control, responding instantly to the slightest variation of throttle-opening, or the least difference of gradient in the track which the car happens to be running over.

There are three cars in the service, which affords a one-hour schedule hourly throughout the day and night between Anderson, Greenville, and Belton; none of the three cars have ever missed a trip and they have never suffered any delay through any trouble whatever. The cars were started here in the nature of an experiment by the General Electric Company, which had some sort of a commercial agreement regarding the use of the tracks of this railroad company. The experiment has been such a howling commercial success that the railroad company has now acquired the cars for itself, and is placing in service larger equipment of the same kind, running on more frequent schedules, and is extending the service to other lines.

Attracted by their success, a railroad which was already building from Atlanta, Georgia, southward through some of the principal small cities of that section, decided to use gasoline equipment exclusively, and forthwith abandoned its negotiations for the pur-

(Continued on page 344.)

Looking aft. A 12-inch, high-explosive shell entered port side of conning tower, burst, split the tower open, tore off the roof and produced the complete wreck of the navigating bridge above it, which is here pictured.

Lee side looking aft. Note 20-ton fragment of the conning tower armor, 12 inches thick, blown down onto the main deck. In the immediate foreground the deck is cut across by a 12-inch shell.

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SINKING A BATTLESHIP AT SIX MILES

The Heavens in April

Our Monthly Astronomical Page

By Henry Norris Russell, Ph.D.

IN the present month, the astronomical event of most general interest is the solar eclipse of the 28th. For suitably situated observers this will be total, and of very considerable duration—almost five minutes at maximum. It will be very hard work, though, to secure such a suitable situation, for, as in the last long total eclipse, the whole track of the shadow lies in the Pacific Ocean, and only a few small islands are available as stations. The eclipse will indeed be total just at sunrise in a very small region at the southeastern corner of Australia, but for this station the sun will be barely above the horizon, and too low for satisfactory observation.

Certain islands, however, are more favorably placed, and from some of these at least two British expeditions, and doubtless others, will watch the phenomena, photograph the spectrum of the solar atmosphere and corona, and secure permanent records of the state of the Sun's surroundings on that date if only the weather permits all this! Fortunately, the probabilities are said to be very favorable.

Almost throughout the United States the eclipse will be visible in its partial phases. The States along the Canadian boundary are too far north to get into the penumbra—or outer fringe—of the Moon's shadow; but at all points south and west of a line drawn through Washington, Chicago, and Portland, Oregon, something will be visible. Those near the line will see only a small portion of the southern limb of the Sun hidden, but observers near the Mexican boundary will find more than half the sunlight obscured, and in southern Mexico the eclipse will be nearly total—the actual track of the shadow lying about 100 miles off the coast.

In California, the eclipse will begin about 3 P. M. (Pacific time) and be over long before sunset. Observers farther east will find the beginning later by their local time, and sunset will cut short the view before the eclipse is over, for all points east of a line drawn from Galveston to Cleveland. On the Atlantic Coast very little can be seen before sunset, and north of Maryland nothing at all.

As is usually the case with great solar eclipses, this one is isolated, the Moon being too far from its node at the preceding and following full Moons to enter the earth's shadow.

Whether we are in a position to see the eclipse or not, we can in any case find much of interest in the starry heavens, which every clear night open to our gaze. Even the smaller constellations have much that is noteworthy to show us, especially if we have a small telescope at our disposal.

Take for example Cancer, which we may find, as our map shows, a little to the southwest of the zenith. There are no bright stars in this group, and even the most active imagination can trace little resemblance in their arrangement to the crab shown in our initial letter. But on a clear moonless night the eye is immediately struck with a faint cloud of light, like a stray fragment of the Milky Way, about half way between Castor and Pollux on the one side, and Regulus on the other. This object (called by the ancients Præsepe the Manger, while the two stars near it are known as the Aselli, or Donkeys!) is shown even by a field-glass to be a cluster of stars of the seventh and eighth magnitudes, invisible singly to the naked eye, but impressing it by their combined light. Telescopically, it affords a very fine low-power field. The star ι (Iota) Cancri, shown on our map at the north of the constellation, is a fine wide double, with components of the fourth and sixth magnitudes 30 seconds apart. A powerful field-glass should divide the pair, but telescopic aid is necessary to show the contrasted colors (yellow and blue) of the components.

More interesting, though demanding higher telescopic power, is ζ (Zeta) Cancri. This star, though not shown on our map, can be easily found by carrying a line from Castor southward through Pollux and dropping a perpendicular from Præsepe on this. A small telescope divides it into two components of somewhat unequal brightness, and a higher power shows that the brighter one is itself a closer pair.

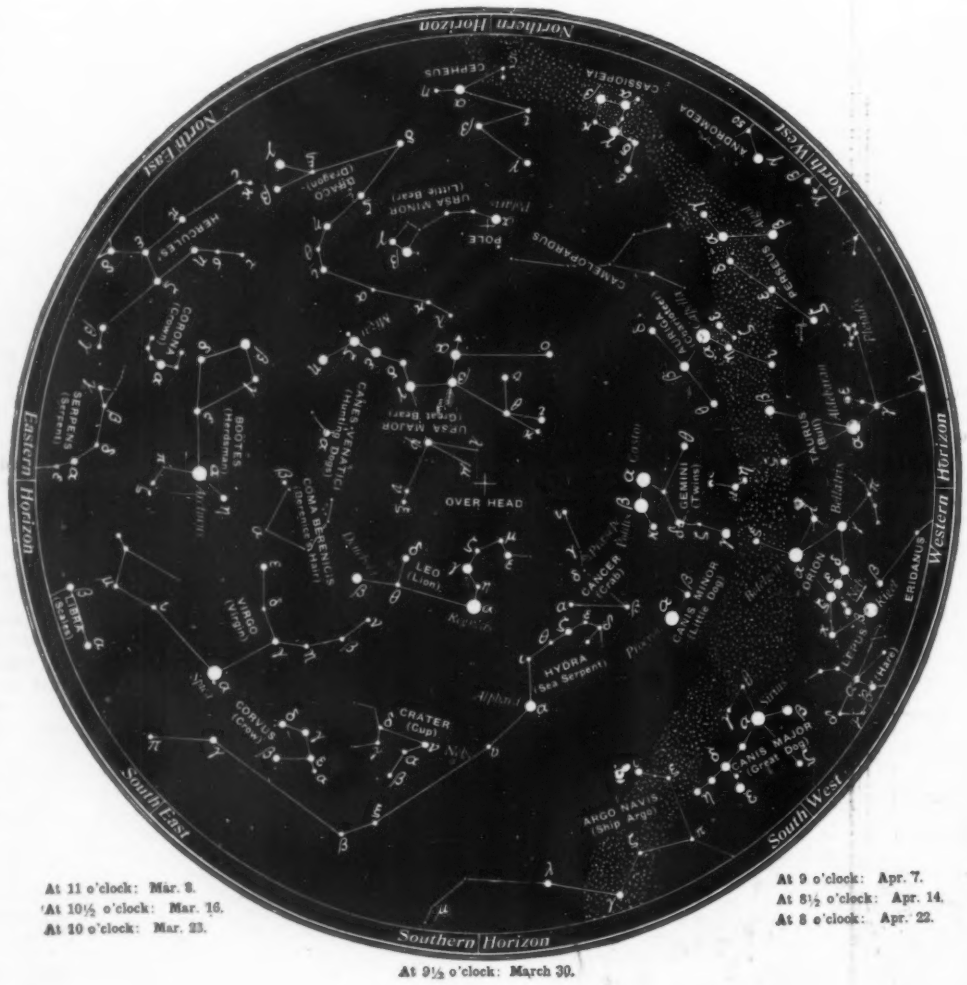
The stars of this are in orbital motion about one another, and have completed two revolutions since the first observation by Herschel in 1780, the period being sixty years. At present they are near their widest separation, at an apparent distance of one second of arc, and can be seen double with a four-inch aperture. When closest, as in 1870, they are only half as far apart, and only a larger telescope will separate them.

The third member of the system is in slow revolution about the binary pair. So far, its motion has been nearly uniform, and if this continues to be the case, the period of revolution will be about 700 years.

The motion of this star is not uniform, but shows a succession of very similar loops, each of which is described in about 18 years. The most probable explanation of this is that this star has a dark companion of mass comparable with itself. The center of gravity of the two moves in a smooth curve about the distant pair, while the visible star, describing a small orbit about this moving center, is drawn into the looped path revealed by the micrometer measures.

Careful observation with the most powerful telescopes has failed to show the hypothetical companion, but this need not lead us to doubt its existence, for Sirius and Procyon have similar companions, visible only with large apertures, and so faint that if the systems to which they belong were removed so far that the brighter stars looked as faint as Zeta Cancri does to us, their companions would be invisible with our greatest instruments.

Turning to our map to identify the remaining constellations, we find Taurus, Orion and Canis Major low in the west, Canis Minor and Gemini above them, Auriga and Perseus in the northwest, Cassiopeia and Cepheus below the Pole, Draco and Ursa Minor farther to the right, and Ursa Major high above them, almost overhead. The very bright red star, nearly due east, is Arcturus. Below and on the left are the Northern Crown and Hercules, the latter rising. The bright star in the southeast is Spica, in Virgo. The still brighter object below this is the planet Jupiter. Leo is high in the south, and below him the sea-serpent, Hydra, drags out its mighty length, extending far toward the southeast, while the Crow and the Cup stand upon its back.



At 11 o'clock: Mar. 8.
At 10½ o'clock: Mar. 16.
At 10 o'clock: Mar. 23.

At 9½ o'clock: March 30.

At 9 o'clock: Apr. 7.
At 8½ o'clock: Apr. 14.
At 8 o'clock: Apr. 22.

NIGHT SKY: MARCH AND APRIL

THE PLANETS.

Mercury is now an evening star in Aries, best visible about the 14th, when he is farthest from the Sun. His apparent distance from the latter is just under 20 deg., but being well to the north he is favorably placed for observation, setting about 8:15 P. M. He should be readily visible as a bright twinkling object, almost equal to Sirius, about 15 deg. below Venus, and very near Saturn (with whom he is in conjunction on the 10th). Mercury is the more northerly of the two, and much the brighter.

Venus is evening star, and exceedingly conspicuous. On the 1st she sets about 8:45 P. M., while at the end of the month she remains in sight till nearly 10 o'clock. She is so bright that her light, passing across a room from a western window, makes an easily visible patch on a white wall, and she is easily visible in the daytime if the eye has only some guide to her position. An excellent one will be furnished near noon on April 1st, when the Moon is close to the planet—the two, as seen from our latitude, being separated by only about half the Moon's diameter.

Mars is morning star in Capricornus and Aquarius, rising about 3 A. M. in the middle of the month.

Jupiter is in Libra. He is in opposition on the 30th, and is visible all night, though early in the month he does not rise till nearly two hours after sunset.

Saturn is evening star in Aries at the beginning of the month, but is steadily being overtaken by the Sun, and passes behind him on the 30th. Uranus is in Capricornus, and is in quadrature with the Sun on the 20th, coming to the meridian at 6 A. M. Neptune is also in quadrature on the 9th, but is east of the Sun, and souths at 6 P. M.

The Moon is in her first quarter at 1 A. M. on the 6th, full at 9 A. M. on the 13th, in her last quarter at 1 P. M. on the 21st, and new at 5 P. M. on the 28th. She is nearest us on the 2d and on the 30th, and farthest off on the 18th. She is in conjunction with Saturn and Venus on the 1st, Neptune on the 6th, Jupiter on the 14th, Uranus on the 21st, Mars on the 23d, Saturn again on the 28th, and Mercury on the 29th.

Princeton University Observatory.

Handy Men's Opinions of Handy Man's Workshop

THE Editor of Handy Man's Workshop is greatly encouraged by the hearty and overwhelming support given him in response to the referendum. Many valuable suggestions have been received. Best of all, a number of readers have presented problems on which they wish the help of a handy man. One man writes: "I have a light automobile which I can run right up to the back door of my house. I know that I can buy a good vacuum cleaner to be run by this power, but it is pretty expensive. Can I buy a pump and rig up the rest of it myself? I don't care for looks (I want it effective), so I might use a barrel for the tank, have water in the bottom to catch the dirt, etc. Where can I buy the hose and nozzle? Has anybody worked it out along this line? Another reader requests a description of a self-winding electric clock, a wireless telephone, and a hand power ice machine. Still another reader would like to have practical suggestions for building aeroplanes. The Editor welcomes queries of this sort, and hopes that there will be a ready response to them.

Only one man has raised his voice against the Department. He says: "The Handy Man's Workshop in your paper appears to me to be like a mechanic with inferior tools going to work with saw and hatchet and nails in his pocket. Of course, this is all right for a beginner, but if I would hire a good carpenter I should expect him to come with hammer, hand ax, rip saw, hand saw, nail box with assorted nails, etc., and not with a combination tool suitable for all purposes."

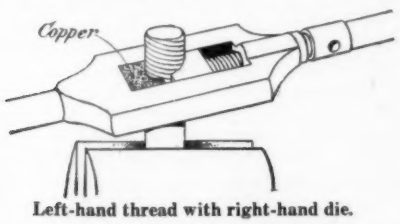
So far there has been such a landslide in favor of Handy Man's Workshop that the Editor is loth to close the polls. Men who are handy with tools are seldom handy with the pen, but the Editor does not ask for any literary effort. He wants the opinions of all readers of this Department written in the handiest way.

Cutting Left-hand Threads

To the Editor of Handy Man's Workshop:

I was very much interested in reading in your issue of the SCIENTIFIC AMERICAN of the 15th of October last a method by A. F. Bishop for cutting a left-hand thread with a right-hand tap, and as a layman fond of mechanics I would like to give a description of a simpler method of cutting a left-hand thread with a right-hand *die*, also a method of threading a nut to fit the same with a right-hand *tap*.

Take an ordinary stock with split dies, discard one



Left-hand thread with right-hand die.

die and substitute a piece of soft red copper similar in size, slightly beveled where the teeth should be to allow of its being canted. Fix your rod in the vise and apply the stock and die in the usual way, but with the end of the stock nearest the steel die canted upward. Then tighten up the dies, and with a slow motion work the stock steadily to the left, and after a couple of turns it will be found that the copper die has taken the impression of the teeth, and the dies can now be tightened and the thread cut to any depth without trouble.

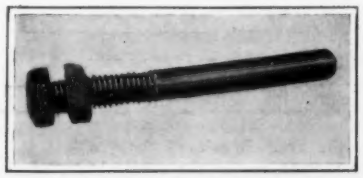
To nut the above, you must use the ordinary three-fluted tap, filling in two grooves with soft copper wire to put two sets of teeth out of action. Secure these wires both at top and bottom by binding the ends with fine brass wire, and soldering them to make them rigid; trim the copper wire with a file, and when suitable tap a blank nut, working left-handed, and after a few trials it will be found quite easy to nut a bolt and make it serviceable for ordinary repair work.

W. J. HEWETT,
Tide Surveyor, Imperial Chinese Customs.
Kowloon Customs, York Buildings, Hong-Kong.

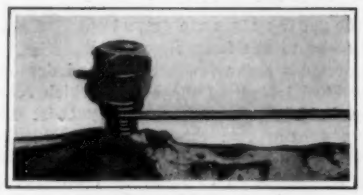
A Wire Stretcher

AS a guy for a flag staff, for a clothes line or to suspend a curtain, or for any other purposes too numerous to mention, nothing is better than a tighly stretched wire; but it is somewhat difficult to properly tighten and secure one without special appliances. The one herewith illustrated, while it *is* special, may be very easily made and used by any one. It is nothing more than a common bolt, with the head removed and with an extra nut, as shown in Fig. 1.

Having secured one end of the wire, bore a hole of the exact size of the bolt in the tree, post or timber to which the other end is to be attached and drive the bolt in nearly up to the first nut. Pull the wire as tightly as possible and bring the end half around the bolt between the nuts, which have been left far enough apart for that purpose, then screw the outer one down tightly upon it. Be sure to have brought the wire over the bolt on the right side so that when



Bolt prepared for stretching wire.



The wire stretcher in use.

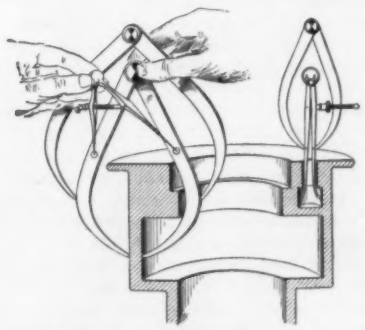
the nut is tightened and the bolt begins to turn it will tend to be wound on rather than to be unwound. As the bolt begins to turn press the wire inward till it bends over the inner nut and begins to wind on the body of the bolt, as shown in Fig. 2; then, if you have bored the hole at right angles with the direction of the wire, it is simply a matter of turning till the desired tension is attained.

Of course, the size of the bolt required depends upon the size of wire used, but the relative sizes shown in the illustration are about right. A very great strain may be attained in this way, and it is necessary that the object to which the wire is fastened be very firm. Under ordinary conditions no strain which the wire will withstand will be sufficient to pull the bolt around and unwind it; but, if it seems expedient, it may be made unquestionably secure by nailing a block of wood so that it will bear tightly against the side of the outer nut. If one desires a specially neat and secure job, he may mortise out a block to fit the nuts and fasten it over the whole.

Calipering Webs and Chambered Holes

By Albert F. Bishop

THE novice is quite apt to be baffled if required to caliper a chambered hole or the web of an H-shaped piece. He may close the calipers on the web, but he cannot remove them without loosing the measurement. In the SCIENTIFIC AMERICAN of March 4th, one solution of the problem was published. It consisted in providing each leg of the calipers with a mark made by a prick punch, so that by setting a pair of dividers to these marks when the calipers are closed on the web, and then setting the calipers to the



Calipering webs and chambered holes.

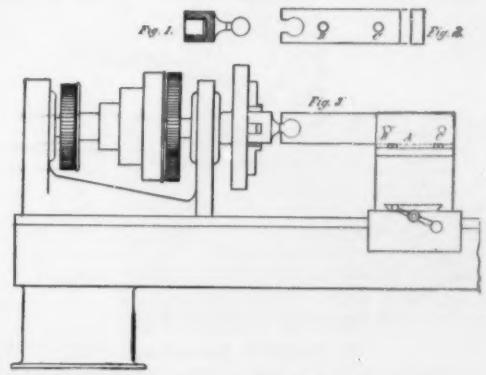
dividers when they have been removed from the web, the desired measurement may be obtained. Another method which is shown in the accompanying engraving is to use a second pair of calipers to caliper the first pair while its points are in contact with the web. A chambered hole may be calipered in the same way, as illustrated.

Machining Balls and Sockets

By H. D. Chapman

THE accompanying drawing shows a tool for forming ball ends, and the way it is used in the lathe. We had about three hundred ball ends to machine for connection rods for pivot bar sights. These ball ends are made of bronze. How to turn them was quite a problem, and Fig. 1 shows the ball which was to be turned, Fig. 2 the special tool we made, and Fig. 3 the way in which the tool was used.

The first operation was to rough the balls to within 0.02 inch of the required size, so that we could finish them to size with the special tool. The tapered pro-



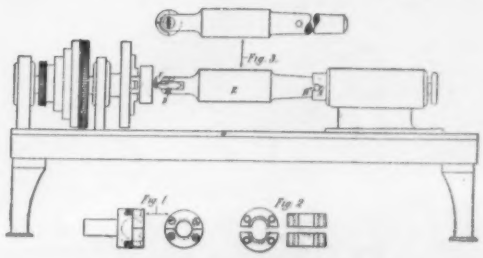
Method of turning ball ends.

portions were finished at the time that the ball was roughed.

The rig consists of but two parts, the tool which is shown in Fig. 2, and the angle bracket *A* for holding it. The tool, Fig. 2, is a piece of flat tool steel with a parallel hole, the diameter of the ball, and ground to clear the neck of the ball. It is provided with two taper holes *B* and *C*. The bracket *A* is an L-shaped casting tongued on the under side to fit the tool-post T-slot so that it will not slip and can be bolted to the cross feed. The bracket *A* is grooved out to the width of the tool, Fig. 2, and of the correct height, so that when the tool is secured to it by the tapered pins, the ball outline will be on the line of the lathe, when the cutting face of the ball is square with the cross slide in both directions. The ball end is driven by a three-jaw universal chuck. The tool is fed in by the cross slide until it reaches the center, then the ball is finished. The non-cutting half of the tool acts as a support in one direction, from the thrust of the cutting half.

This kind of a tool worked quite satisfactorily and did the work in half the time that was expected.

A large number of sockets were made on a speed lathe as described below. In the accompanying drawing the sockets are shown in Fig. 1, while Fig. 2 shows the caps for the sockets. The speed lathe was



Method of turning sockets.

rigged up with a special tool, as shown in Fig. 3. The socket joints were machined all over to a finished size and then sent to the speed lathe for the ball seat to be made.

The taper shank of the special tool was made to fit the taper in the tail stock. A slot was cut through the face of the center carrier at *A* and a hole was drilled through the taper shank of the tool and a 5/16-inch dowel was driven in this hole as shown at *B*, and where the tool was placed in position the dowel pin *B* would seat itself in seat *A* in the tail stock, thus preventing the tool from turning in the center while the tool was cutting the work.

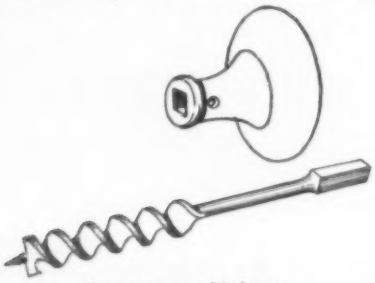
This tool was gotten up at a slight cost in comparison with a nose cutter. It consisted of three parts, the holder *E*, cutter *C*, and locking pin *D*. The cutter *C* was made of tool steel hardened and ground all over, the largest size of the cutter being that of the finished size of the ball seat. One quarter of the cutter was cleared away at the top and bottom. The cutter *C* was held snugly in position by the locking

pin *D* drawing the two ends of the tool holder together, thus causing enough friction to prevent the tool from turning. The ball caps shown in Fig. 2 were machined in the same way.

An Emergency Bit Brace

By Claude L. Woolley

IT often happens when one desires to use a bit in a corner, that a ratchet brace is not at hand, or that when a bit is required for use no brace at all is at hand. In such a case a door knob from any convenient door may be used. The square hole in the knob will permit of its being slipped over the shank of the bit, and the bit may then be turned quite successfully by grasping the knob with the hand.



An emergency bit brace.

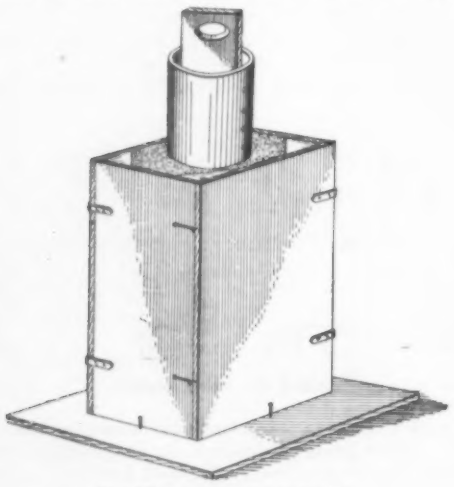
Making Concrete Tile

By Charles J. Hackenberg

CONCRETE tiles become harder and stronger with age, and may be made as porous as clay tiles; in comparison the clay tile becomes water-soaked and disintegrates in the years of service, thus causing broken tiles and a useless drain. The accompanying sketch shows a device for making a 6-inch tile, and from this explanation any other tile may be easily constructed.

A box form is built of two boards, 18 inches long and 8 inches wide, and two boards, 18 inches long and 10 inches wide. These are joined together to make a form, the inside measurements being 8 × 8 inches and 18 inches high. Fasten these boards together with two hinges at each of three corners, and the fourth corner fasten with two hooks and eyelets. This allows the machine to be folded back from the tile without injury. Now nail in each corner of this box some three-cornered strips 18 inches long, but nail to one side of the board only.

For the core take a 6-inch stove pipe, 24 inches long, and inside the same place a 6-inch board, 30 inches long, nailing it securely. The top of this board is cut to make a handle to draw out the core. The bottom is cut down to leave a small ¾-inch projection or pin, which enters into the holes bored in the pallets, thus centering the core in the form. The pallets are made of any boards larger than the form used for molding the tile, and in the center is bored a ¾-inch hole to receive the pin on the bottom of the board in the core.



Mold for making concrete tile.

The outside part of the mold is held in position by four iron pins or spikes. Set the casing in the correct position on the pallet, and then on each side mark where the pin is to be placed. Bore a hole for the same, and arrange it so that it can be easily inserted and removed.

A pallet is prepared for as many tiles as you wish to make each day, and the tiles are left on it for at least forty-eight hours before removing, when they may be piled up and the pallet used again.

In operation the mold is placed in position on the pallet with the core in place. The mortar is placed in the mold and tamped down. Add mortar and tamp down until the mold is filled. Now simply draw out the core and unhook the sides and fold back from the tile, leaving it upon the pallet to dry for forty-eight hours. The tiles thus made are 18 inches long and are octagonal, which is a convenient shape for laying.

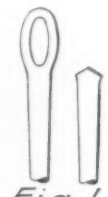
A great advantage of concrete tiles is that each tile is perfect, while the clay tiles are very apt to draw out of shape in burning, and thus make trouble when laying them.

Kinks from an Amateur's Bench

By John D. Adams

SMALL DRILLS.

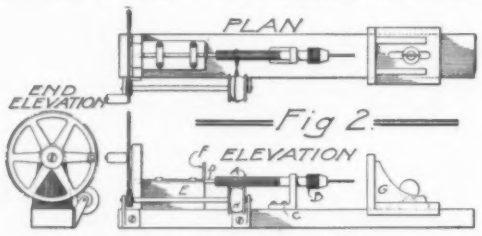
FOR making small holes, from one-sixteenth to one sixty-fourth of an inch in diameter, the twist drill has to be handled very carefully on account of the small actual cross section of metal. Partly for this reason and partly as a matter of convenience the writer was led to make some drills from ordinary cambric sewing needles. The results were quite satisfactory, both as regards cutting qualities and durability. Referring to Fig. 1, it will be noted that the needle shank widens out a trifle to form the eye. Break off the eye with the pincers, secure the needle in some temporary handle, and then grind it rather flat on each side, after which the cutting edges are ground on the oil stone to the form shown. All of this occupies but a few minutes and does not disturb the hard temper of the needle, which retains its edge much longer than the ordinary twist drill. If one does considerable experimental work, the best plan is to lay in a stock of needles running from darning needles down to those used for fine sewing. Break off all the heads first, then grind the sides, and finally go over the set and finish the cutting edges on the oil stone.



A drill from a needle.

SMALL DRILL PRESS.

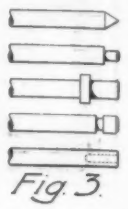
While a small breast drill is indispensable to the experimenter, it is not very satisfactory when using small drills. It requires considerable experience to drill straight, and it is almost impossible to hold the drill steady enough to avoid widening the hole toward the top. To obviate this, the small "drill press" illustrated in Fig. 2 was improvised—all at an expense of fifteen cents, the cost of the small pin vise. These vises consist of only two pieces—the shank *A*, which is threaded on one end, and the taper nut *B*, the tightening of which closes the jaws. The shank is usually knurled and has a small hole drilled in the end. A bracket *C* forms the forward bearing, while the back end is supported by a pin *D*, which is arranged to slide in a groove in the block *E*. A small arm *F* affords the means of moving the pin *D*, and therefore the drill, forward. A bracket *G* is made to slide on the base and may be clamped by a small thumb screw, which is easily improvised by soldering a piece of sheet metal into the head of an ordinary wood screw. The drill may be operated by the old-fashioned cord and bow, or by simply passing a piece of string around the shank of the pin vise and drawing it back and forth. If the works of an old clock are at hand, it is a very easy matter to arrange some simple gearing like that shown in Fig. 2. The mainspring wheel is provided with a small handle and is arranged to turn on a vertical wooden standard. The pulley *H* is made from a small silk spool. A small rubber band, doubled and crossed, forms an excellent belt that is easily replaced and very flexible in operating, so that a drill will seldom be broken. When using, clamp the base in the bench vise. Crude as this apparatus is, it will drill holes of small diameter of considerable depth and at right angles to the surface without that widening that always results from a drill supported by the hand.



Home-made horizontal drill.

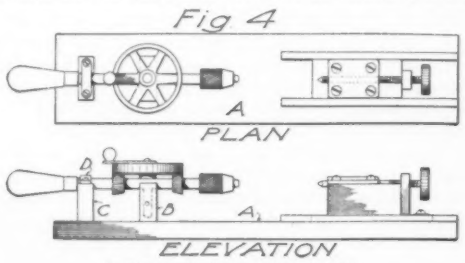
IMPROVISED LATHE.

Very often we are required to finish the end of a small shaft to one of the forms shown in Fig. 3, and on account of the absence of a lathe we are baffled. No matter how accurately we may attempt to wield the file, the result will be disappointing unless the work revolve while being filed. If a small breast drill is at hand, it may be quickly arranged to impart the desired rotary motion—and a lathe could do little more.



Work done on the home-made lathe.

Upon the base *A* is fastened a block *B*, drilled to receive the pin which holds the handle that projects from the side of the drill, the handle having, of course, been removed. Block *C* is notched on top to hold the shank near the handle. A small clamp *D* serves to keep the drill in place. A tail stock may be made in many ways, according to one's needs and the material at hand. The method shown in the drawing is obvious. The body is simply a block of hardwood glued to a thin under strip, which runs between two guide strips attached to the base board. For such work as that indicated in Fig. 3, no tool guide will be necessary, as the whole operation may usually be very neatly done with a file. In fact, if the piece to be turned is short, the tail stock may be omitted, and the job done with the work projecting from the revolving chuck. The rotary motion permits of the polishing of small shafts, screw heads, etc., in truly professional style, and it is only a matter of a moment to remove the drill from the wooden base.



Lathe made from a hand drill.

A Punch Used in Boiler Shops

IN making a punch for punching boiler iron, the parts which are indicated in the accompanying engraving at *A* and *B* are generally made in one solid piece, which is the punch proper, while the part indicated by the letter *C* is the holder, which is inserted in the power press. Mr. George Clark has hit upon making the part *A* a separate piece, which is the only piece that needs to be tempered, thus requiring only a small amount of steel when renewing the punch. The piece is more easily tempered, more quickly made, and more economical. In fact, the punch is better every way.

Hints from Handy Men

Painting Window Screens.—When repainting window screens and screen doors, give them a couple of coats of white paint, or else use a light tint, in place of the conventional black or dark green. Screens painted in this way possess the peculiar advantage of presenting an unobstructed view to a person on the inside looking out, while a person on the outside is prevented from looking into the house by the reflection of the light from the wire of the screen.

Machining Work Square in a Lathe.—It is considered by some impossible to machine a piece square in a lathe without special attachment. But it can be done quite simply as follows when there is no other machine at hand: Clamp a toolmaker's vise to the face plate, place the piece to be machined in it with enough projection to permit of facing off one side. Then place the finished side toward the fixed jaw and machine the next face, and so on until the desired work is done. If care is taken in clamping, the job may be done to a surprising degree of accuracy and in short time.

How to True Up Carborundum.—Carborundum and India oilstones soon become worn in spots, and may be cut down by the following simple method: Take a flat piece of machine steel and rough-plane it on one side; or if you can, get a piece of a large emery wheel that has been broken. Next get some No. 40 or 60 emery, and spread it on the plate or wheel and rub the same as in lapping. When the stone commences to get sticky, clean off the plate or wheel and stone and then put on new emery. Repeat until the stone is perfectly flat, which will only take ten or fifteen minutes. After the stone has been trued up it can be cleaned with benzine, and it will be as good as a new stone.

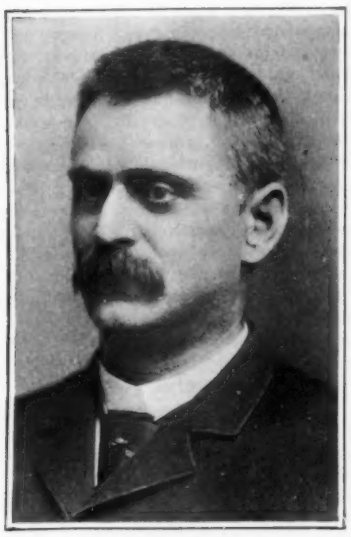
The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

Louis W. Maxson

Principal Examiner of Division Fourteen, U. S. Patent Office

MR. LOUIS W. MAXSON, whose picture is shown, is one of the best known examiners of the United States Patent Office, and in point of service as



Louis W. Maxson.

principal examiner is pretty well up toward the top of the list. Mr. Maxson was born in California, educated in the public schools of Norwich, Connecticut, and graduated at Yale College in the class of 1876, subsequently taking the degrees of B. L. and M. L. at Columbian (now George Washington) University in Washington, D. C. For four years after graduating from Yale he taught in collegiate preparatory schools and then entered the Patent Office as an assistant examiner in 1880. Passing through the grades of assistant examiner, he was in 1889 appointed Primary Examiner and assigned to Division 14, over which he has continuously presided to the present time. Although he has served in but two divisions in his more than thirty years tour of duty in the Patent Office, he has personally examined a broad field of important inventions, having been in direct charge, either as principal examiner or as the assistant, of the following classes: Fire Arms, Ordnance, Navigation, Signals, Fishing and Trapping, Stone Working, Advertising, Sheet Metal Ware Making, Wire Working, Metal Founding, Packing and Storing, Baggage Carriers, Coin Controlled Apparatus, Metal Personal Wear Making, Cutting and Punching Sheets and Bars, Wire Fabrics, Farriery Tools, Compound Tools, Metal Bending and Nut and Bolt Locks. The practical development of can-making machinery, incident to the greatly increased commercial demand for products of such machines, has occurred largely during his charge of Division 14.

Shortly after his promotion to his present position he was appointed a member of the special committee charged with the examinations from time to time of the assistant examiners, and he subsequently served on all but one of the similar committees or boards.

Any sketch of Examiner Maxson would not only be incomplete, but would also be entirely inadequate, if it failed to make some reference to his personality. To know him is to appreciate his sympathy and to realize that he breathes a helpful spirit. Whether as a neighbor, a churchman, or as an official exercising judicial functions in the treatment of patent applications, the same wholehearted, cordial, manly man is found, with a hand stretched out to help wherever help is needed or desired.

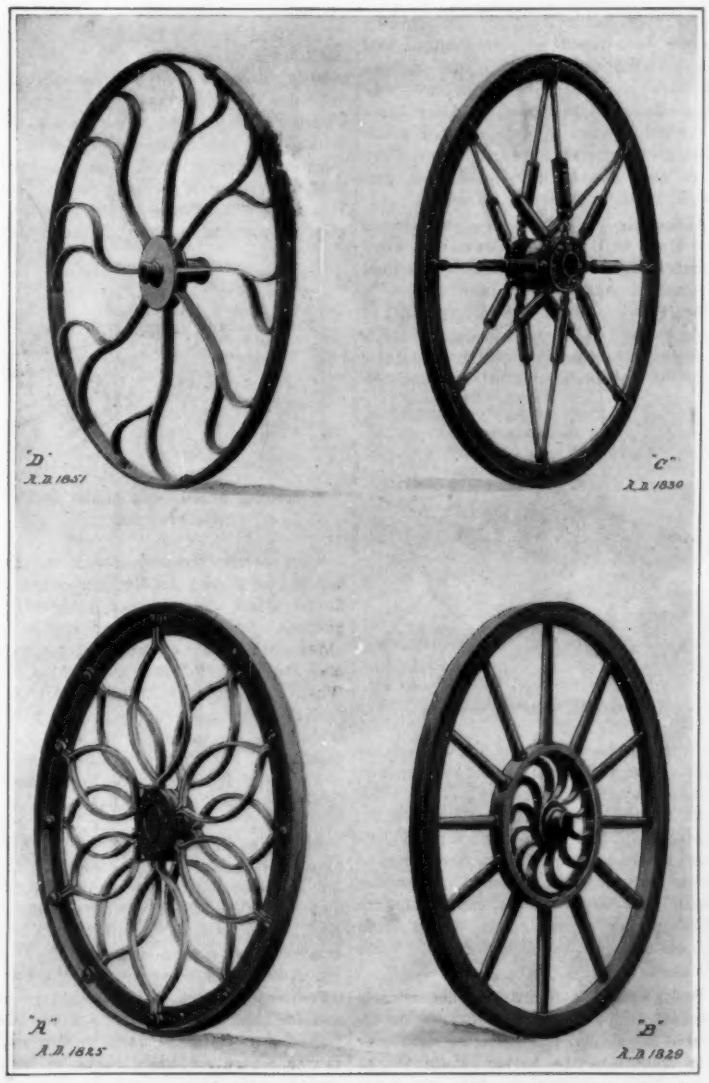
Like most vital, energetic men of his kind, Mr. Maxson has hobbies running all the way from archery, of which he is recognized as a leading exponent, to fruit culture, his success in the latter field, especially with the small fruits, being the subject of much remark.

Physically, the subject of this sketch is built on generous lines, and his mind is fitted to the body. His activity and energy are proverbial, and although he has been examiner in charge of a division for more than twenty years, he still finds time from his executive work to do actual examining to an extent that would put the record of many an assistant examiner to the blush.

Elastic Spoke Wheels.—An Old Idea in Invention

THE development of the automobile, especially along the lines of heavy trucks and other freight-carrying vehicles, has emphasized the desirability, if not the absolute necessity, of some provision in lieu of pneumatic tires for giving resilience to the wheels and thus easing the jars and jolts incident to the passage of motor-driven vehicles over rough roads. This has led to much activity among inventors along the line of spring wheels, and many important advances are being made looking toward the production of an ideal spring wheel with especial reference to its availability for use on automobiles.

Viewing the present improvements in spring wheels, it is interesting to note the spring wheel shown in cut "A" having spring spokes similar to the ordinary elliptical carriage springs, between its hub and rim. This wheel was patented in England in 1825. Another form of spring wheel shown in cut "B" was patented in France in 1829, and has a wheel with inner and outer rims and ordinary spokes between them, while bent or curved spring bars are located between the inner rim and the hub. A wheel patented in England in 1830 and shown in cut "C" utilizes coil springs operating in connection with the spokes to give the yielding action, and the wheel shown in cut "D" and patented in the United States in 1851 illustrates still another form of yielding wheel.

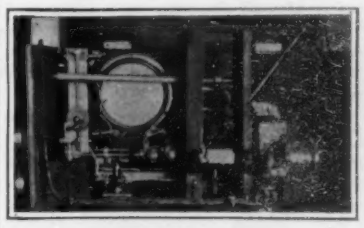


Some early elastic spoke wheels.

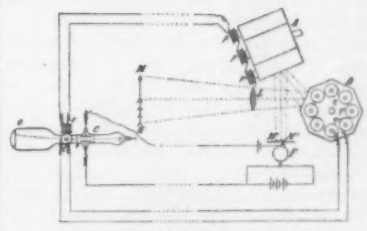
The "Telegraphic Eye"

By Dr. Robert Grimshaw

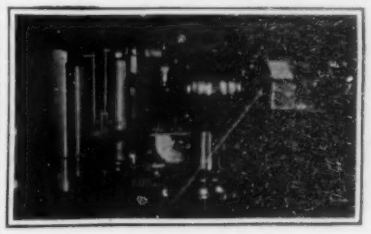
THE three accompanying illustrations show a diagram and general view of the latest form of "telegraphic eye" designed by Prof. Rösing, of the Imperial



The Receiver.



Diagrammatic Plan View of the Rösing "Telegraphic Eye."



The Transmitter.

The Rösing "telegraphic eye."

Technical Institute in St. Petersburg.

In the general view both the sending and the receiving station are shown, connected by six conductors. It may be mentioned that the inventor has recently worked out an arrangement with only three lines of conductors.

The sending station is shown on the right-hand side of the plan, the receiving station on the left. The transmitter consists of two rotating multiplying mirrors, *A* and *B*, the axes of which lie at right angles to one another; their rates of revolution are purposely made unequal, and are so calculated that during their rotation every individual point of the image *M' N'* of the object *M N*, which it is desired to reproduce at the receiving station, comes in turn before the opening *a* of the diaphragm of the photo-electric receiver *F*. The mirrors operate a number of small dynamos *p p' p''* and *q q' q''*, which, when the mirrors are rotated, generate electric currents, synchronous with the movements of the mirrors themselves, and also with those of the images to be transmitted. These currents, as also those proceeding from the photo-electric element *F*, when the light from the individual points falls on this latter, are reproduced at the receiving station.

At this last a pencil of cathode rays produced in a Crookes tube forms an essential feature. In obedience with the electro-magnets *s* and *t*, which are ex-

cited by the currents proceeding from the dynamos p and q, the pencil of cathode rays is deflected by varying amounts in the direction of the two co-ordinate axes, synchronously with the movements of the picture $M'N'$ with reference to the corresponding axis. As a result, the spot of light formed at the point where the pencil of cathode rays meets the fluorescent screen O will go through the same movement in relation to the screen as the opening a does relatively to picture $M'N'$. At the same time the spot will change in brightness in proportion to the brilliancy of the corresponding points of the picture $M'N'$ (and hence of the object MN). This result is attained by connecting the photo-electric element F with the condenser C in the Crookes tube, so that the latter becomes charged more or less strongly, in proportion to the intensity of the light falling upon F. The condenser, accordingly, attracts the pencil of cathode rays with a varying force, and compels it to pass more or less completely through the opening of the diaphragm o, and to fall on the fluorescent screen.

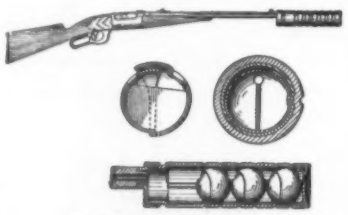
As Prof. Rösing's experiments have shown, and as one would expect, considering all that is known of the cathode rays, this form of electric telescopy has yielded results such as have been obtained with none of the earlier forms of apparatus, in which mechanical movements are made use of at the receiving station. We know that the cathode rays have practically no inertia, no friction, and are not subject to vibrations; in other words they possess none of the undesirable properties which limit the action of the most perfect mechanism, especially considering the great velocity of motion required in the reproduction of visible signals by means of the electric telescope. The time admissible for giving a signal may here amount to only a few millionths of a second.

The electric telescope here shown is, of course, not to be considered as the final solution of the problem. The inventor has already found it necessary to introduce some improvements; and there are still certain obstacles to be overcome. This will be understood by all who have had to do with electric telescopy, and who therefore know what difficulties stand in the way of a solution of this problem. Nevertheless, in view of the giant strides which physics has made in the investigation of electric and optical phenomena, and of the aid afforded by the refined instruments which science has given us, there can be no doubt that the solution of the problem is near at hand.

It is not necessary to emphasize in great detail the importance of electric telescopy. Apart from the fact that it allows us to see through obstacles and to span any distance, as though we viewed things with our own eyes, new possibilities are opened of seeing that which no human eye has yet perceived. By fitting this electric eye with a strong electric lamp and sinking both together to the depths of the sea, we shall be able to systematically explore the ocean bed. It is difficult to say what innumerable scientific and material treasures are hidden in the unknown portions of our globe. Such an apparatus can also be employed for researches concerning the crust of the earth by letting it down into a volcanic crater, into chasms and crevices of mountains, or to the bottom of deep artesian wells. Electric eyes will most probably be employed on lighthouses and at military posts. With the help of this eye the commander of an army or of a fleet, working with the aid of an airship, will be able to observe the movements of an army or fleet. And finally, this invention can be of great service in the industries by enabling the engineer or superintendent to inspect his plants, shops, and other installations from his desk or office. In fact the possibilities presented to our minds are apparently inexhaustible.

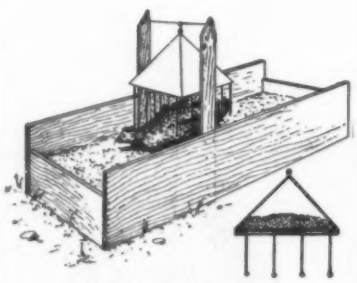
Patent Oddities

Hollow-ball Gun Muffler.—Our attention has been drawn to a very regrettable error in an article and illustration which appeared on pages 95, 96 of our issue of January 28th, a form of gun muffler invented by Mr. G. F. Childress being erroneously ascribed to Mr. Maxim. We are anxious to correct this mishap and to give credit for this invention to the rightful owner. The following is a somewhat more detailed description of the Childress gun-silencer than was given in our earlier publication. As shown in the accompanying diagram (which is reproduced from the drawing of United States patent 953,943, issued to G. F. Childress on April 5th, 1910), there is attached to the nozzle of the gun a prolongation or cylindrical case, containing a number of hollow balls. Each ball is traversed by a perforation normally placed in alinement with the bore of the gun, and serving for the passage of the bullet. The ball is made of two halves, each approximately hemispherical in shape, and strengthened by a median rib or septum lying in a vertical diametral plane. The function of this is to prevent the ball from being crushed by the force of the blast at the explosion. Each ball is held in place by two annular shoulders running around the inner wall of the muffler case. The gases, as they sweep out from the explosion chamber, are caught in the series of hollow balls, and thrown thereby into rapid eddying motion, this action being also aided by the median partition within the ball. In this way the pressure of the gases, as they leave the nozzle of the gun, is reduced somewhat gradually, their energy being dissipated through the eddying motion produced by the sudden discharge.



Hollow-ball gun muffler.

Automatic Poultry Duster.—Realizing that dust will kill lice, fowls will avail themselves of every opportunity to dust themselves thoroughly. However, it is difficult for the fowls to apply the dust to their backs. When the dusting of fowls is done by an operator, the dust is quite liable to be taken up into the lungs, resulting in discomfort, if not actual injury. For this reason an inventor has devised a scheme whereby a fowl can dust its own back. It consists of a receptacle formed with a perforated bottom from which a number of rocker arms project. As the fowl passes beneath the reservoir it comes against these rocker arms and in lifting them causes the dust to be sifted down upon its back.

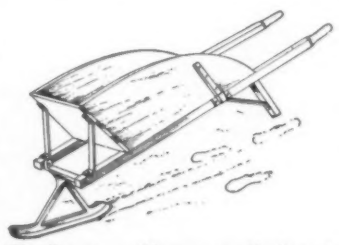


Automatic poultry duster.

Flour Sifter.—An inventor has recently devised a flour sifter which may be operated in one hand, so that the cook may sift flour into the batter, while at the same time stirring it with the other hand. The flour sifter consists of the usual pan with a wire mesh bottom, and arranged to slide over the wire netting is a sifting foot made of wire. This sifting foot is connected to a spring extension on the handle of the flour sifter so that when the flour sifter is grasped in the hand the sifting foot may be swung from side to side by merely gripping and releasing the spring section of the handle.

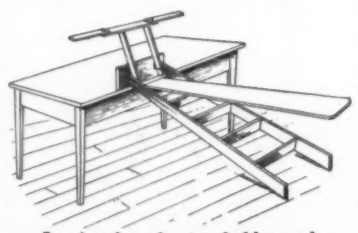
Ingenious flour sifter.

Runner Attachment for Wheelbarrows.—An inventor who hails from the Northwest has found it expedient to remove the wheel from his wheelbarrow in winter time and to substitute in its place a sled runner. The runner is formed with a crosspiece which fits between the bars of the wheelbarrow and is attached thereto by the axle rod of the wheelbarrow. As no special adjustments are necessary, the runner may be removed at a moment's notice and replaced with the ordinary wheel.



Wheelbarrow with runner attachment.

Combined Ironing Board, Step Ladder, and Clothes Rack.—The city home is becoming so small that any device which combines the advantages of a number of separate articles should be hailed with delight by the householder. The accompanying illustration shows a household utility which serves three purposes. If arranged as shown in the drawing it may be used as an ironing board. The ironing board, however, forms the back support of a step ladder, and when the device is set upon its feet it serves this purpose. Furthermore the device is provided with a pair of folding arms which may be extended to support clothes. When used as an ironing board the device must be used in connection with a table, the top step of the step ladder resting on the surface of the table, the end of the ironing board being caught under the edge of the table top.



Ironing board, step ladder and clothes rack.

Ferdinand J. Rochow, a mechanical engineer, who died at his home in Brooklyn on March 16th, was the inventor and patentee of a rotary pump in 1861, which is still manufactured. Hardly a year has passed since then in which his name has not appeared in the Patent Office Record. One of his late inventions was for a car in which live fish are transported. It would be hard to find an inventor whose activities cover so long a period and whose inventions have withstood the test of time.

Notes for Inventors

John Hays Hammond in Patent Litigation.—Johns Hays Hammond, the celebrated mining expert who has been appointed the Spècial United States Ambassador at the coronation of King George, has been made a party, with others, to a suit brought in the Supreme Court of the District of Columbia by Mr. Daniel J. Sully, at one time known as the Cotton King, some transactions in connection with a cotton gin, the invention of a well-known Washington inventor, Mr. Willard Doremus, being involved. Damages to the amount of one and one-half million dollars are claimed.

Charles E. Mitchell.—Mr. Charles E. Mitchell, who was Commissioner of Patents in 1889-91, during President Harrison's administration, died on Saturday, March 18th, 1911, at his home in New Britain, Connecticut. Mr. Mitchell was a native of Connecticut, having been born in that State at Bristol. After graduating from Brown University, he attended the law school at Albany, New York, graduating in 1864 and taking up patent law. In the Patent Office, he was immediately preceded as Commissioner by Benton J. Hall, and succeeded by William E. Simonds, and it is doubtful if there ever was in the history of the Patent Office a succession of three abler men. As Commissioner, Mr. Mitchell showed an ability which put him well up in the ranks of distinguished patent lawyers who have filled that high office, bringing to the position an extensive experience in patent matters which proved of great assistance to him in his conduct of the Office.

Investigation of the Heany Patent Applications.—Testimony is now being taken before Hon. C. C. Billings, First Assistant Commissioner of Patents, in the investigation directed to be made by the Commissioner of Patents of the charges of fraud in various applications for patent filed by John Allen Heany. The purpose of the Patent Office investigation is to determine the validity of certain applications for patent for electric lighting, and Congress passed an appropriation of several thousand dollars to cover expenses incurred in the investigation, including traveling expenses, expenses of witnesses, cost of copies of testimony and other expenses incident to the investigation. Apart from the importance of the inventions involved, the investigation is interesting and unique, as it is certainly the most extensive, if not the only proceeding of its kind ever instituted by the Patent Office.

The Dental Drill of the Future.—The writer of this note is neither electrician nor dentist, but in common with most of the laity he has spent many hours in a dentist's chair and has noticed him use the dental drill driven from a suspended electric motor by means of a flexible shaft to the free end of which the dental tool is connected. This is a big advance over the foot-operated drill some of us older ones remember; but is it too much to hope, or even predict, that with the progress being made with storage batteries, the dental drill of the near future may be emancipated from the serpentine flexible shaft and carry within itself the electricity and motor, and be re-charged from time to time, when laid down temporarily, from a suitable source of supply.

Some Legal Decisions.—The decisions handed down by the U. S. Court of Appeals for the District of Columbia on March 7 included nine patent appeals from the commissioner of patents, all of which were in contested cases and the decisions of the Patent Office were reversed in five out of the nine cases. Chief Justice Shepherd had eight of the cases and reversed the Patent Office holdings in five out of the eight cases, while Mr. Justice van Orsdel had one of the cases and affirmed the decision of the Patent Office.

The Plow as a Military Weapon.—Without regard to the sentiments of the

verse which says "And useless lances into scythes shall bend, and the broad falchion in a plowshare end," two joint inventors of New York State in June, 1862, patented a combined plow and gun. The plow is of ordinary construction except for the beam. This is made hollow or tubular to constitute a cannon bore, having a vent hole at its rear end. It is described as unrivaled as a means of defense in repelling surprises and skirmishing attacks, as it can be immediately brought into action by disengaging the team, and "in times of danger may be used in the field, ready charged with its deadly missiles of ball or grape." The share is described as serving to anchor firmly in the ground and resisting recoil, and the handles as furnishing means of giving direction to the gun.

Commissioner's Report—The Commissioner of Patents has transmitted his report for the fiscal year 1910 to the Secretary of the Interior. The printed copies have not yet been issued, but it is understood its principal recommendation is for new and larger quarters for the patent office, a subject dear to the hearts of all interested in the inventing public.

Legal Notes

Patent Appeals and the United States Commerce Court.—According to persistent rumors, there is considerable prospect of the vesting of jurisdiction of patent appeals in the newly organized United States Commerce Court. This would avoid the necessity of a new Court of Patent Appeals as provided for in a bill before the last Congress and would permit appeals from the United States Circuit Courts, or what will, after next January, be the United States District Court, directly to the Commerce Court, at Washington city. At least one member, Judge Archbold, of the Commerce Court has had a large experience in the judicial determination of patent causes, and there is reason to believe the court would welcome the enlargement of its scope in the manner above indicated.

The Chartreuse Case.—Mr. Philip Mauro, the well-known patent attorney, who, until recently, was abroad, visited Washington during the middle of March especially for the purpose of arguing the celebrated Chartreuse case before the Supreme Court. Mr. Mauro represented the French Carthusian monks, Mr. A. L. Pincoffs of New York appearing for the other side.

Delphine Delmas as a Patent Lawyer.—A case argued before one of the tribunals of the Patent Office, and in which Mr. Delphine Delmas, at one time Harry Thaw's attorney, was opposed to Mr. Frederick P. Fish, the prominent Boston patent lawyer, recalled the fact that the writer once saw Roscoe Conkling and Robert G. Ingersoll leaving the Patent Commissioner's room after a hearing at a time when those distinguished lawyers were engaged in active practice.

Cost of Assignments.—The recording of assignments of interest in patents is sometimes an extremely expensive piece of business for the Patent Office. An example of this is found in an assignment recently put on record in connection with the consolidation of two large companies. While the assignment only contained 14,400 words, which formed the basis of the recording fee, it affected 1,043 patents, or about one patent to each thirteen and one-half words of the assignment. The fee paid for recording was sixteen ($16) dollars. The record shows that the labor of preparing the deed for record, digesting it, revising, recording and comparing necessary in spreading the deed on the record, took, measured in one clerk's time, 171 hours, equal to 24 days and 3 hours, which, charged for at 50 cents per hour, the rate charged by the Patent Office for assistance in connection with the records, would amount to $85.50, or more than five times the amount actually paid to the Patent Office for the service.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

The weekly *Index of Patents* issued by the *United States Patent Office* will be found in the *Scientific American Supplement*.

Pertaining to Apparel.

TUBE.—M. F. ANDERSON, New York, and G. W. BUCHANAN, Peekskill, N. Y. The aim in this invention is to provide a tube more especially designed for use as a stiffener in caps and like articles, or as a protector for nesting hats and for other purposes, the tube being exceedingly light and flexible to permit of readily bending it into curved shape to conform to the shape of the article on which the tube is used at the time.

Electrical Devices.

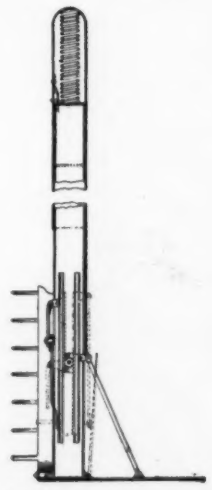
ROSETTE.—B. NEALIS, Fulton, N. Y. The filament of the tungsten (electric) lamp is of such delicate nature that it can withstand little shock, and to increase the life of the lamp the present device is devised, having for its purpose in addition to providing a yielding support, to eliminate the possibility of the conductors contacting with the fastening screws, and to make it unnecessary to remove the cap of the rosette in applying or removing these screws.

LOCKING DEVICE FOR TELEPHONES.—W. A. SOLES, New York, N. Y. The device is arranged to lock the switch lever or supporting hook for the receiver in place to prevent unauthorized persons from making use of the telephone. For this purpose, use is made of a brace engaging the telephone support and the switch lever, and a lock for holding the brace against removal from the switch lever.

SIGNAL LOCK.—H. BLANK, New York, N. Y. The object here is to produce a latch or lock which may be used as an auxiliary attachment for a window or door, and which will normally operate to leave the door or window unlocked, but when an attempt is made to open the door or window, the device operates to lock the door against being completely opened and at the same time it closes a circuit so that an alarm, such as an electric bell, will be rung.

Of Interest to Farmers.

COMBINED HOE AND RAKE.—HERBERT L. MCKIBBIN, Clayton, Mo. The invention illustrated herewith provides a combination tool having a rake member on one side thereof and a hoe member on the other, each of said parts



COMBINED HOE AND RAKE.

being capable of being folded back while the other is in use. By a novel form of mechanism both parts may be operated simultaneously, one part coming into operative position while the other is folded back out of operative position. The relatively movable parts by which the operations are effected are operated by a handle.

SEED TESTING CABINET.—B. H. ADAMS and W. C. ADAMS, Decorah, Iowa. The object of this invention is to provide a device for testing corn and other seed whereby the seed can be tested so as to determine which of the seeds are good and which are unprofitable for use. It consists of a cabinet provided with removable drawers or trays having foraminous bottoms supporting an absorbed or bibulous pad on which the seeds are placed, and heating apparatus at the bottom of the cabinet.

CATTLE STANCHION.—C. O. BRAWN, Brillion, Wis. This invention is an improvement in cattle stanchions and has for an object among others to provide a novel construction of stanchion wherein the stanchion will be locked or held in position after the cow has entered her head when the device is open, and will be free to turn when the cow has her head locked in the stanchion.

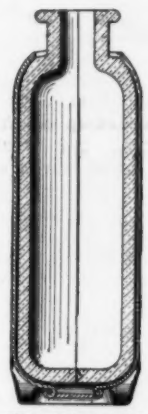
Of General Interest.

HORSE OVERSHOE.—C. A. CONOVER, 53 Water Street, Newburgh, N. Y. This invention refers to horse overshoes, intended mainly for the prevention of slipping in instances where the horse is used temporarily in some relations where extraordinary precautions are required to prevent slipping. More particularly

HORSE OVERSHOE FOR PREVENTING SLIPPING.

stated, the invention illustrated provides two plates to be fitted upon the under side of the foot, which may be already provided with a shoe, these plates being adjustable relatively to each other for feet of different sizes, and being held in position by aid of straps and wire links. Canvas calks may be provided as substitutes for the plates just mentioned.

TWO PART BOTTLE.—EDWARD N. BREITUNG, Marquette, Mich. The inventor provides a bottle made in halves, which are detachably connected together by aid of a spring-strap and are easily taken apart in order to be cleaned. The improvement pictured in the engraving comprehends a bottle made in halves, one pro-



TWO PART BOTTLE.

vided with a tongue and the opposite one with a groove into which said tongue fits, the halves being provided with grooves and being connected together by a strap of spring metal practically encircling the entire bottle and resting in the groove, the strap having a clasp for detachably connecting its ends together.

GATE.—E. COWELL, New York, N. Y. In this case use is made of a frame, preferably adapted to swing on a post and having an extensible baffle mounted thereon, adjustable rollers being connected with the baffle to normally adjust the same after the baffle has been extended, and the lower side of the frame being preferably padded to ease the force of impact of the runaway against the gate.

CURRENT MOTOR.—L. GUYNN, Seattle, Wash. One of the chief objects of the invention is to provide a motor adapted to project paddles into the water automatically and to a certain required depth so as to utilize in a maximum degree the force or power of the water current, and to reduce to a minimum the friction of the revolving portion of the apparatus.

FITTING STAND FOR OPTICIANS.—J. FRIEDLANDER, New York, N. Y. The intention of this improvement is to produce a stand for fitting customers' glasses, having a mirror and an eyeglass case disposed opposite to each other and arranged so that either the mirror or the eyeglass case can be swung around into any position desired or folded when not in use.

STEAM TRAP.—C. A. DUNHAM, Marshalltown, Iowa. The invention refers to certain improvements in thermostatic steam traps, and more particularly to the construction of the thermostatic device, the means for supporting the same, and the means for preventing leakage from the casing around the device. All features are equally applicable to other forms of steam traps, drain traps, drain valves, air valves and other thermostatic regulators in which a thermostatic disk is employed.

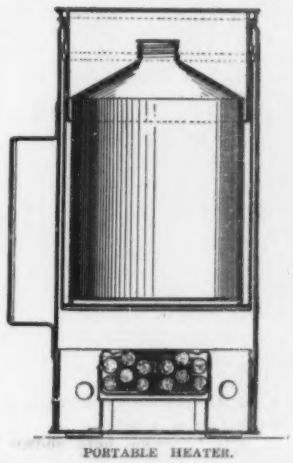
WATER SHOE.—K. HELLMANN, New York, N. Y. The object here is to provide a shoe for enabling a person to move forward on a lake, river or other body of water, and arranged for convenient attachment to the foot, and having sufficient buoyancy to properly support the user on the water and to enable the user to rapidly glide over the surface of the water without danger of sliding backward.

HORSESHOE CALK.—J. P. VAN WYCK, Hudson, N. Y., Dec'd., A. B. VAN WYCK and A. P. VAN WYCK, Executrices. The invention resides primarily in the mode of applying the calk to the shoe, this being effected in a way to cause the natural pull on the calk by the horse, tending to separate the calk from the shoe, to force the calk hard against the under side or tread of the shoe, whereby the calk is not only wedged to place but is afforded a firm bearing.

Heating and Lighting.

PROCESS OF MAKING GAS.—J. J. NIX, Alhambra, Cal. The more particular purpose in this case is to make a combustible gas continuously with a minimum of waste of both heat and materials. It comprehends the heating of a furnace or other receptacle and the continuous precipitation therein of carbonaceous material in gaseous form, and the continuous supply to said material, of steam, or air, in order to form the combustible gas.

PORTABLE HEATER.—FRANK B. ELLIS and JAMES L. WALKER, Wharton, Texas. This invention is designed for heating water for

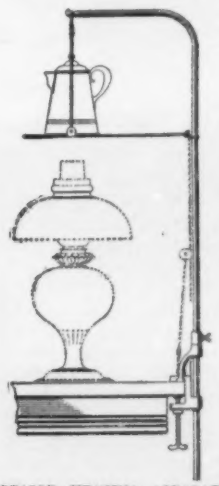


PORTABLE HEATER.

boiler and other purposes, or for use as a cooking stove in camping. It has in view a heater having all the essentials for heating water, cooking, etc., including a flask for the fuel, a vessel for holding the water or food, and an extra cup or receptacle, all adapted to fit within and be incased by the body or outer jacket of the heater when the heater is completely assembled. The body or jacket is upright and tubular and has a handle as shown in the engraving, by which it can be moved about.

Household Utilities.

PORTABLE HEATING APPARATUS.—HENRY C. STOUT, Mount Sidney, Va. This small, easily portable, and inexpensive apparatus is adapted for convenient attachment to a shelf, table leaf or ledge, or to a vertical wall, for use in supporting receptacles for liquids or solids requiring to be heated. The leading feature and shown in the view is a hinged shelf or tray formed of a circular plate or frame with a lateral extension hinged to



PORTABLE HEATING APPARATUS.

the crane. The tray is held in horizontal position and supports a coffee pot as shown, or other receptacle for liquid or solid to be heated, the same being supported over the lamp, in place of which of course a gas flame may be employed.

BAKING APPARATUS.—C. F. HARTMANN, New York, N. Y. This invention relates to

apparatus for use in fashioning ornamental or other articles from suitably forming sections of pastry or the like, and relates more particularly to apparatus comprising a pan, and a removable member associated therewith and having means for dividing a layer of dough in the pan and for maintaining the dough against malformation, due to spreading while baking.

PIPE CLEANER.—W. COLINA and M. McL. REID, Waterbury, Conn. This invention has in view a cleaner for waste pipes of sinks, wash trays, etc., that have become choked. It has a tubular handle through which the cleaning member passes and is adapted to extend to either side thereof, the handle having an effective spring clamping device for securing it in adjusted position at substantially any point along the length of the cleaner.

COVER ATTACHMENT.—T. MCCABE, Homestead, Pa. For the purpose of automatically lifting the covers off of kettles and like vessels without soiling or injuring the fingers, the inventor provides a bearing with a lever mounted thereon, said bearing being adapted to be attached to a vessel and the lever to engage the cover of the vessel by the knob, the cover being adapted to be disengaged from the vessel when the bail of the vessel engages the lever.

Machines and Mechanical Devices.

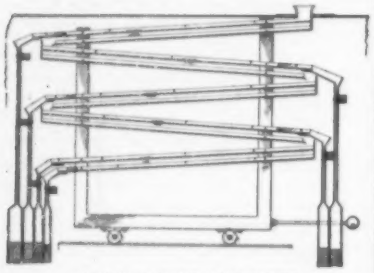
MACHINE FOR FILLING BRUSHES.—O. B. HOOVER and M. CURRY, Killeen, Texas. In the present patent the invention is an improvement in machines for filling brushes; and the object is to provide a simple, efficient machine of the character specified which will be especially adapted for filling with bristles, brushes for clothes, hair or gins, and for securing the bristles in the article.

COPY HOLDER.—B. F. PEETZ, H. S. MCDANEL and N. W. THOMPSON, Moro, Ore. An object of the invention is to provide a copy holder in which the copy may be held and fed forwardly by the mere act of operating the typewriter machine. A further object is to provide a device which may be attached to an ordinary typewriter or to a book typewriter, with almost no change in its operating parts.

STOP MOTION FOR LOOMS.—W. POLLOCK and E. S. LING, Townholm Factory, New Mills, Ayr, Scotland. This invention pertains to gauze and other looms provided with center weft fork stop-motion mechanism that it may be used with advantage where in such looms a shuttle carrying two cops or pirns of weft is used, the weft passing out from opposite ends of the shuttle so that they lie one behind the other in the shed.

STEERING GEAR.—E. WERNDL, Pyrach Post Garsten, near Steyr, Austria-Hungary. This invention provides a steering gear for airships, dirigible balloons and flying machines, and provides for turning the craft to right or left and up or down, or to perform any reasonable composition of movements, all by aid of two steering wheels disposed one above the other and in close proximity, these wheels being journaled upon an axis fixed relatively to the general framework of the machine.

COIN-HANDLING APPARATUS.—ALBIN J. NOTT, 4122 Perrier Street, New Orleans, La. The object of the invention pictured in the engraving is to sort out coins of various sizes and deposit the same sized coins in hoppers, each coin being automatically registered before passing into the hopper, so that a complete tally of the individual sized coin is recorded.



COIN-HANDLING APPARATUS.

Use is made for this purpose, of a series of inclined chutes having baffles and provided with slides having receiving hoppers at their ends for coins, said hoppers being so arranged as to receive coins of similar size only, and means for registering the number of coins in the hopper, and for vibrating the chutes to facilitate the movement of coins down the chutes.

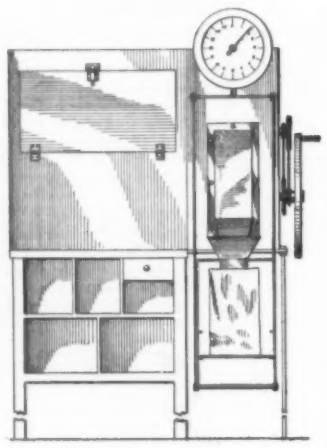
AIR LOCK.—W. H. FLAHERTY, New York, N. Y. The aim of this improvement is to produce an air lock the doors of which can be operated conveniently from the interior of the lock, the construction being such as will enable a great force to be applied to the doors in opening or shutting them, giving more room and preventing accidents which usually occur with the swinging type of door.

AIRSHIP.—J. O. BROOKBANK, Driftwood, Pa. The purpose of the inventor is to provide a simple, strong, and mechanically efficient airship, which can be propelled with or against the wind, which can be raised or lowered in the air, and which resists any tendency to deflect it from its normal direction of movement.

COIN-OPERATED MECHANISM FOR VENDING MACHINES.—L. HORINKO, New York, N. Y. This invention provides a chute arranged to prevent malicious clogging; provides means whereby coins introduced carelessly or with unintentional violence will be placed in operative position without loss or disarrangement of selecting mechanism; provides means to eliminate coins of smaller size and lesser weight than the coin designed for operating the vending mechanism; provides means for varying the balancing weight; and provides means for preventing accidental deposit of light weight coins.

FLYING MACHINE.—H. MITCHELL, St. Paul, Minn. This invention relates particularly to means for automatically maintaining the equilibrium of the machine, without the necessity of any physical or mental effort on the part of the operator. A further object is to provide an automatic equilibrium control, for manipulating planes or portions of planes operated by a pendulum member.

VENDING CABINET.—MICHAEL R. MAHER, Zanesville, Ohio. The accompanying engraving shows a cabinet from which may be delivered accurately and certainly the material to be weighed; and other principal objects of the invention are: To provide a delivery chute and sack holding scales tray adapted to accommodate sacks of different dimensions; to provide a bin for holding the material to be handled and agitating devices mounted therein for delivering the material in the path of the chute previously mentioned; and to provide a cabinet adapted to contain sacks and accessories for receiving and packing the goods being handled.



VENDING CABINET.

WEAVING LOOM.—G. E. LEVY, 27 Rue du Mail, Paris, France. This invention has reference to a double shedding motion for weaving looms, with automatic maintenance of the open shed, by an automatic device for hooking and unhooking a simple heddle-operating shedding bar in the raised and lowered position, merely by the direct action of the card needle.

Railways and Their Accessories.

CEMENT AND STEEL RAILROAD TIE.—W. J. HORN, Lamar, Mo. In this case the invention has for an object, among others, to provide a novel construction of reinforced concrete railroad tie. The tie may be made of the usual or any desired length and the ties being alike as to concrete body and reinforcing frame, may be substituted one for the other whenever for any reason one tie becomes broken or otherwise impaired.

ATTACHMENT FOR DIAPHRAGM FACE PLATES.—V. LABADIE, Dallas, Texas. This attachment is for use on vestibuled passenger cars, and the object of the inventor is to provide auxiliary wings which have set-off portions, and are secured to the rear faces at the outer edge of face plates such as are now in use to close any opening caused by lateral movement of one of the face plates relatively to the other when rounding a curve.

AUTOMATIC CHECK VALVE FOR TRAIN PIPE COUPLINGS.—JAMES C. KEPNER, New Cumberland, Pa. This improvement provides a check valve which, when the train is coupled, will be held away from its seat so as to permit the passage of air into the train pipe, but

AUTOMATIC CHECK VALVE FOR TRAIN PIPE COUPLINGS.

which, if the main coupling should break and the pipe coupling should fall apart, would reseat so as to prevent the sudden discharge of air from the train pipes and the sudden setting of the brakes.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

THE AMERICAN ARTISAN WINDOW DISPLAY MANUAL. Chicago: Daniel Stern, 1911. 8vo.; 271 pp.; illustrated.

The suggestions and arrangements offered are confined to hardware. It is a comparatively easy matter to place in a shop window some curiosity or design that will attract a crowd. It is quite another matter to make the window a "silent salesman" that will bring patronage to the proprietor. The writer has endeavored to keep the more important purpose to the fore. Several of the illustrations show prize-winning designs. Others specialize on such goods as nickel-plated ware, fishing tackle, tools and sporting goods. Still others show attractive dressings for Christmas, New Year's and Thanksgiving, while a Washington's Birthday display utilizes the episode of the boy and the cherry tree to call attention to hatchets. The manual will be particularly helpful to retail dealers in the smaller towns who are sometimes at a loss to know just how to dress their windows to the best advantage.

THE FOUNDATIONS OF ALTERNATE CURRENT THEORY. By C. V. Drysdale, D.Sc. (Lond.), M.I.E.E. New York: Longmans, Green & Co., 1910. 8vo.; 300 pp.; 190 illustrations. Price, $2.50 net.

The author endeavors to impart a knowledge of his subject by the use of simple mechanical analogies. While admitting the general use by teachers of mechanical illustrations of the theory, he believes that this is the first attempt to give a complete and logical exposition of it by the use of a mechanical basis. This method reduces the mathematical work to a minimum, holds the attention of the student, and gives him a valuable physical conception of processes and results. Very simple apparatus is sufficient for laboratory work. The author has used the method for five years in his lectures before the Northampton Institute. Indeed, the work as here presented is a *résumé* of the theoretical portion of that course.

ELECTRICAL POCKET BOOK AND DIARY. London: Technical Publishing Company, Limited, 1911. 567 pp.; illustrated. Price, cloth, 50 cents net; leather, 75 cents net.

This stocky little annual has been brought down to date, and new matter has been introduced on the various rotary-converter equalizer systems; on balancers and boosters; on metallic filament lamps, and on the Edison storage cell. Altogether a large fund of information is compressed between its covers, and a feature of its make-up is the section of blank pages at the back, ruled as a daily record.

SEEHAFENBAU. Von F. W. Otto Schulze. Band I. Allgemeine Anordnung der Seehäfen. Mit 248 textabbildungen. Berlin: Wilhelm Ernst & Sohn, 1911. 8vo.; 359 pp.

This work on harbors is, so far as it goes, enlightening and thorough. A second volume will issue under the sub-title "Ausbau und Austattung der Seehäfen." The varying types of harbor are dealt with according to their main uses, whether primarily naval bases, commercial ports, fishing harbors, or refuges in case of storm. Also according to location, within rivers or at the river mouth, island havens, or coast harbors; and in reference to their formation, natural or artificial. Plans and maps of the most noteworthy harbors of the world are included, and space is given to the various arrangements of wharves and slips.

ENGINEERING OF TO-DAY. By Thomas W. Corbin. Philadelphia: J. B. Lippincott Company, 1911. 8vo.; 367 pp.; 39 illustrations and diagrams. Price, $1.50 net.

The man who allows the title of this volume to deter him from reading it, because he knows nothing of engineering, is unconsciously foregoing a pleasure. It is safe to say that this popular exposition of well-known but little-understood devices is just what many of us have been waiting for. Those of us who have an overwhelming sense of our own ignorance in the presence of a steam-engine should examine for a minute the full-page drawing entitled "The Soul of the Steam-Engine," in which a cylinder is represented as if transparent, thus enabling us to see what takes place within its walls. The gas-engine is similarly explained by simple description and illustration, and this simplicity and clearness is carried through the entire range of subjects, from the making of big guns to submarine diving; from the trolley-car to war vessels; from running water to the railway.

GAS-ENGINE DESIGN. By E. J. Stoddard. Detroit: Parker & Burton. 4to.; 100 pp. Price, $1.

The pamphlet starts with an introduction on compressed air. It discusses, in ordinary language, gasoline and air mixtures, valves and helical springs, the strength and proportion of parts and the sparking coil. Diagrams are presented for obtaining without calculation the pressure and volume during compression, the maximum explosion pressure and the theoretical indicator diagram. The large pages permit of large drawings, whose smallest parts are thus readily seen and their functions easily understood.

THE EXCELSIOR CODE SYSTEM. Three volumes. 3,181 pp. Price, single set, $50. Two sets, per set, $47.50.

The ideal telegraph and cable code should allow of freedom and accuracy in expression; it must not easily lend itself to misinterpretation, either by the use of words readily mistaken one for the other, or by errors of transmission; and it must reduce expense to a minimum. That the codes in general use are far from meeting these requirements satisfactorily any broker or shipper will admit. Often defective or mutilated parts of a message have to be repeated, entailing delay that not infrequently results in loss to buyer and seller. Prices decline a fraction of a cent, and the opportunity of advantageous sale passes before the amended message can be deciphered and its instructions carried out. In comprehensiveness and accuracy the Excelsior System aims to surpass any at present in use. Its one and a half billion phrases, covering staples, quantities, numerals, dimensions, dates and stock market transactions, insures the highest freedom of expression. Commerce, finance, industry, insurance, labor, law, medicine and shipping are among the interests especially catered to, and space is left for the alphabetical insertion of private code phrases. As to accuracy, a system of check is furnished by which the correction of mutilated words is in most cases possible without resorting to repetition and its attendant delay. Economy has also been kept well in mind by the author of the system, which is capable of two applications—that of the ordinary vocabulary, preferable for inland service, and that of the condensed code form, the scope and economy of which is peculiarly adapted for long-distance and trans-oceanic cabling. This feature provides means whereby any two phrases of a message may be rendered in a single code-word. The frequent necessity for secrecy has not been overlooked.

SUGGESTED RULES FOR RECOVERING COAL MINES AFTER EXPLOSIONS AND FIRES. By W. E. Garforth, M.I.C.E., F.G.S. New York: D. Van Nostrand Co., 1910. 12mo.; 71 pp. Price, $1.50 net.

There are few disasters that hold so much of potential horror as do those of the coal mine. The loss of life is apt to be heavy, and the superhuman conditions imposed upon the rescue work, the long suspense and the final bringing to light of the bodies of the victims, all are elements surcharged with grief and tragedy. All possible thought and knowledge should be brought to bear upon the amelioration of the conditions attending such disasters. The author has divided his suggestions into two parts, those dealing with precautions to be taken before the accident, and those providing rules for guidance after the accident has taken place. The first part considers the appointments, stores, appliances, ventilation and the training of men necessary to establish a state of preparedness. The second part is graphically interpreted by the use of an admirable plan of the Altofts Pit, showing the disruption of 1886. The plan is a large insert upon linen, and the falls of roof, the bodies, etc., are indicated diagrammatically and in colors. These rules, then unwritten, were applied to the recovery of the Altofts Pit and their success in that and in later instances makes them worthy of study with the view of adapting them to the conditions prevailing in our own mines.

CONCRETE WALL FORMS. By A. A. Houghton. New York: The Norman W. Henley Publishing Company, 1910. 62 pp.; illustrated. Price, 50 cents.

This is No. 1 of a series of concrete worker's reference books, and explains the construction of the various types of wall forms, clamps, separators, and spacers for reinforcement, treating also of foundations, retaining walls, the placing of floor joints, molding water tables and window ledges, and the molding of fireproof walls. The automatic wall clamp, which is clearly described and illustrated, permits of building without difficulty monolithic walls with a continuous air chamber.

CONCRETE FLOORS AND SIDEWALKS. By A. A. Houghton. New York: The Norman W. Henley Publishing Company. 63 pp.; illustrated. Price, 50 cents.

This is No. 2 of the series of monographs on kindred subjects, and proceeds from the simplest forms of floors and sidewalks to the most ornamental tile effects. There are timely warnings as to the reason for common defects in the work. It is the author's claim that the greatest measure of success is usually secured by the simplest and most inexpensive methods, and his best results are obtained by the use of easily-made molds of strap-iron.

BACKBONE OF PERSPECTIVE. By T. U. Taylor. Chicago: The Myron C. Clark Publishing Company, 1910. 12mo.; 56 pp.; illustrated. Price, $1.

The student will find this to be a helpful little manual on a subject not without difficulties of its own. First the primary principles of plan and projection, lines, points, and planes are set out by problems and diagrams; then the vanishing-point method is applied to monuments and buildings; axometric projections are given a chapter to themselves; and the rules governing the perspective of shades and shadows conclude the treatise.

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Manufacturing business (incorporated) product, heating specialty, protected by patents, will bear close investigation, good reasons for selling, $15,000 required. J. D. Ayres, Masonic Temple, Elmira, N. Y.

LIBERAL ROYALTY TERMS to manufacturers to make Telescoping Mud Guards for Bicycles, Patent 979,074 dated December 20th, 1910. Address. R. E. Kelly, Cocoanut Grove, Fla.

YOUNG MAN WITH TECHNICAL EDUCATION—M. E., eight years in general manufacturing. Will invest $15,000 in good manufacturing proposition. State clearly your proposition in first letter. Address: "L" 5610 Washington Ave., Chicago, Ill.

FOR SALE.

PATENTS FOR SALE.—U. S. Patent No. 957,622 and patents in 7 other countries, a new means for propulsion of vessels. Trial model has shown good results. R. P. Nielsen, Tranebjerg, Denmark.

MANUFACTURING BUSINESS - Outright or part; Presses and special machinery; established trade with best concerns in U. S. Reason, sickness. B. L. Wright, 212 East 59th Street, Chicago, Illinois.

FOR SALE.—The Rice Attachment for Spring Boards patented in U. S. A. and Canada will stand the test, is useful, and is needed on Buggies, Carriages and heavy Wagon Springs. For particulars apply to: Lawrence Rice, Inventor, Cassel, Ontario, Canada.

SPECIAL NOTICE.

A Postal Progress Conference is to be held at Washington, D. C., at the New Willard Hotel, on the morning of April 25th next, under the auspices of the Postal Progress League, of which Frederick C. Beach is president and James L. Cowles is Secretary-Treasurer. "For an Extended Parcels Post." The object is to afford an opportunity for friends of the Post Office, in and out of Congress, to consult as to immediate and future Postal legislation, especially in reference to the establishment of General Parcels Post, up to 11 pounds weight at 8 cents per pound; a cheap local Parcels Post on rural routes and the insurance of all mail matter. The existing rates from Europe to the United States are 8 cents a pound up to 11 pounds; within the United States, 16 cents a pound up to 4 pounds. A rate which is double the world standard. Those interested may address James L. Cowles, Secretary, 125 East Twenty-third Street, New York, whether or not they can attend the conference in person or by representative.

WANTED.

WANTED. A partner with sufficient money. Patent No. 908,379, whereby an engineer can open and close his own switch, from the moving train, by electricity.
W. F. Bath, Bisbee, Arizona.

WANTED.—WE WANT SPECIALTIES IN UNIversal demand, to sell from fifty cents to ten dollars. For full information and particulars, address Stace, Burroughs & Co., 1006 S. Michigan Avenue, Chicago.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big-paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres. The National Co-Operative Real Estate Company, 1378 Marden Building, Washington, D. C.

INQUIRY COLUMN

Inquiry No. 9227.—Wanted, a power-driven saw for cutting down pine trees twenty inches in diameter.

Inquiry No. 9228.—Wanted, to buy fabric tufting machines.

Inquiry No. 9229.—Wanted, addresses of manufacturers of an alloy called Duraluminum.

Inquiry No. 9231.—Wanted, addresses of owners of water falls having a four-foot fall and upwards.

Inquiry No. 9232.—Wanted, addresses of manufacturers of engines that can be run with crude oil.

Inquiry No. 9233.—Wanted, a roller or other device for skinning a beef in rapid, economical manner.

Inquiry No. 9234.—Wanted a small specialty of universal salability to sell from $3 to $10. Proper articles can be financed.

Inquiry No. 9235.—Wanted, names and addresses of manufacturers of machinery and appliances for making celluloid.

Inquiry No. 9236.—Wanted, the name and address of the firm making the New England Filling Machine.

Inquiry No. 9237.—Wanted, information relative to the Parmelee Automatic Aerated Water Still and Sterilizer.

The Michelin Grand Prix

(Continued from page 824.)

wind had enabled him to maintain a high speed.

After a stop of about a quarter of an hour for luncheon, Renaux re-started at 12:07:37 P. M. In an hour and a quarter he reached Moulins. An immense crowd awaited him in the country thereabout. He flew over the city at a height of 1,200 feet and M. Senonque waved to the people that all was well. Following the valley of the Allier he soon reached Gannat (1:37 P. M.), and at 1:55 the biplane was above Riom and almost at its destination.

At Clermont-Ferrand, when the town clock struck two, the great crowd assembled about the cathedral and up in its spires gave a cheer as those at points of vantage were able to discern a grey speck on the horizon. Plainer and more distinct it grew, and larger and larger as it approached at a height of 1,500 feet or more. Fourteen minutes later the biplane passed over the cathedral spires amid tumultuous applause, and, turning sharply, headed for the Puy de Dome, which was dimmed by a light fog. In 13 minutes more it ascended some 3,500 feet, circled about, and descended easily upon the spot prepared for it, which was only a few square yards in size and was marked by wide red bands on the rocky ground. After a magnificent *vol plané*, the biplane alighted easily and Renaux, stiff with the cold, was helped from his seat.

In describing his trip M. Renaux said that soon after the start from Paris he suffered with a cold and with cramps in his stomach. So hard did he have to work at his controls to maintain equilibrium, and so badly did he feel, that when he reached Montargis he almost made up his mind to descend. Luckily, however, the fog dissipated and the weather improved, giving him new courage and causing him to keep on his way. His companion, who was busily engaged studying the map, encouraged him by nods of his head. Near Cosne they came upon the river Loire, and for the rest of the journey they followed this and the Allier, and had no difficulty in finding their way. Nevers was reached and the stop made for replenishment of fuel and for luncheon, as told above. Once more on his way Renaux had some doubts of his accomplishing the journey in 5¼ hours' time, as he had bet his friends he would do if he had good luck and good weather. He wondered if the Puy de Dome would ever show itself on the horizon. He was looking anxiously for the mountain and finally, at Gannat—28 miles away—he discovered it. He then began to climb from 2,300 to 5,900 feet, estimating that this height would be necessary in order to descend upon the summit of the mountain. At Riom he saw loom up in the distance the spires of the cathedral which were his last turning point. In less than ten minutes the machine was above Clermont, and he was within ten minutes of his goal. He wondered if, like the unfortunate Chavez, he would pay with his life for the gigantic victory he had all but accomplished. He had been climbing continuously and now found himself at too high an elevation. At this moment he was at Braque, at the fork of the roads which lead to Moreno and to Ceyssat. He descended again, little by little, as he approached the summit. Finally, at just the right distance, he cut off the spark and glided magnificently to the summit of the famous Puy de Dome.

The distance covered in the first stage of this flight, that is, from St. Cloud to Nevers, was about 141½ miles, while the balance of the journey to Clermont-Ferrand and the Puy de Dome was 93½ miles. The first half of the journey was covered at a higher speed on account of the wind, which was favorable. The last half was covered at an average speed of 41 1/3 miles an hour, the time in flight being 2¼ hours. The total elapsed time was 5 hours, 10 minutes, 45¾ seconds. Deducting the stop at Nevers, the total time in flight was 4 hours, 56 minutes, 38 3/5 seconds, which corresponds to an average speed of 49¾ miles an hour—a remarkably high average considering the amount of "climbing" that was done during the trip. It will thus be seen that the journey was accomplished with

(Continued on page 841.)

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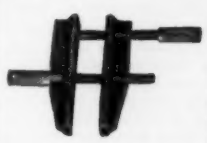

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Notes and Queries

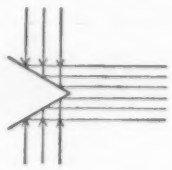
Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12409) C. L. F. asks how to silver ivory. A. Take a small piece of nitrate of silver, and pound it in a mortar. Add some soft water to it, mix thoroughly and put in a bottle. Place the ivory article to be silvered in this solution, allow it to remain until it is of a deep yellow color. Put it then in clear water, and place in the sun. If desired to draw any figure or name upon the ivory, it may be done with a camel's-hair pencil, dipped in the solution. Wash well with water after the drawing has become a deep yellow, and put in the sunlight, occasionally wetting with clean water. Rub it after it has turned a deep black color, and it will change to a brilliant silver. 2. Make a weak solution of nitrate of silver. Immerse the ivory in it, and allow it to remain until the solution gives it a deep yellow color. Immerse in clear water, and expose it in the water to the sun. It becomes black in about three hours. The black surface becomes brilliant silver by rubbing.

(12410) C. T. W. asks how to bend bone. A. If the bone is thin, prepare a solution of common washing soda and water, and heat to boiling point. Immerse the bone, and boil for 30 minutes; then, assuming it to be a bone mouth-piece, push through it a piece of soft steel wire the size of the bore of the bone, bend to the required curve, and withdraw the wire, leaving the bone to set. If the bone shows a tendency to go back to its original curve, bind a bit of soft doubled wire round each end, slip a bit of wood or metal between the strands, and screw tight after the manner of the "stretcher" of a bow-saw. Thick bone should be immersed in phosphoric acid, which may require dilution.

(12411) C. M. A. asks for formulas for honey and almond cream. A. 1. Bitter almonds, 1 ounce; yolk of egg, 1 ounce; honey, 1 ounce; oil of sweet almonds, 2 ounces; oil of bergamot, 15 minims; oil of lemon, 12 minims; oil of cloves, 12 minims. Bruise the almonds, previously macerated in cold water, and decorticated, and rub through a fine sieve; then add the essential oils and the mixture of the yolk of egg, honey and sweet almond oil, and beat the whole well until the ingredients have been thoroughly incorporated. 2. Cold cream, 5 parts; oil of sweet almonds, 5 parts; glycerine, 5 parts; boric acid, 5 parts; solution of soda, 12 parts; mucilage, quince seed (1:8), 25 parts; water, 143 parts. oil of bitter almonds and oil of rose, of each q. s. to perfume. Heat the cold cream, oil and soda solution together, stirring constantly, until an emulsion is formed; then heat together the glycerine, boric acid, mucilage and water, mix with the emulsion, stir until cold, and add enough water to make 200 parts; finally add the perfume.

(12412) J. G. S. says: If two beams of light (either straight or converging) crossed each other at an angle of about 20 or 30 degrees, would it be possible to bind them at their point of crossing so that they would both follow the same axis? If they both came directly toward each other, could they be made to do the same thing? I have consulted several



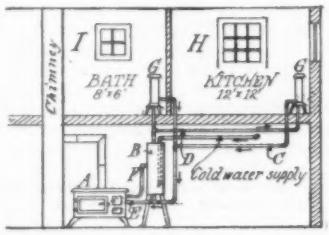
works on light, but none of them seems to explain if this is possible or how it could be done. A. A concave lens will change two beams of light which are converging to render them parallel as in your first figure. A pair of silvered mirrors will reflect two beams of light which are approaching each other so that they will become parallel or convergent as may be desired. We show the effect of the mirrors and the manner of arranging them.

(12413) A. L. G. asks how glycerine is used to harden steel. A. It is stated by the *Pharmaceutische Zeitung* that soft steel placed in glycerine of 1.08 to 1.26 specific gravity, heated to from 180 deg. to 200 deg. C., and let remain for some time, gradually becomes hard, and that the higher the temperature of the glycerine, the harder the steel. We think that our contemporary has forgotten to state that, after remaining in the hot glycerine the stated time, the metal should be suddenly cooled off either in water or in quicksilver.

(12414) W. W. L. asks: 1. Is the current from the secondary winding of a common induction coil alternating? The primary current is furnished by dry cells with interrupter. A. The current from an induction coil, when a direct current is used in the primary, is a pulsating current in the same direction with each spark that passes across the terminals of the secondary. One terminal is positive and the other is negative all the time. When an alternating current is used in the primary, the secondary current is also alternating. 2. What is the use of the intermediate pole on an interpole motor or generator? A. The advantages claimed for interpole motors by their advocates are in the direction of better commutation and its attendant results, sparking diminished, less wear on commutators and brushes, less heating, and similar benefits.

(12415) O. F. says: I am working on an aeroplane and make the front edge as sharp as possible. Another man with same experience in the building of aeroplanes says it will take more power to run the machine if the front edge is sharp than it takes if the front edge is round and a little thicker. Which is right? A. We would say that the latter is the better. The sharp front edge will work after a fashion, but a very powerful motor must be used in order to get up high speed. The Wrights say that the blunt front edge is more efficient also than the taper one.

(12416) A. J. K. writes: I send you a sketch of hot water heating from a 30-gallon range boiler. *A* is the heater and *B* the 30-gallon boiler, *C* the return pipe, *D* the supply pipe, *E* supply to water font or cylinder, *F* hot water to boiler, *G* the radiators, *H* the kitchen (floor space 12 x 12 feet, height 9 feet) has two doors, one to outside facing south, the other to basement. The bathroom next to kitchen exposed only on east wall. I would like to know if I could use the hot water from my range boiler for heating my kitchen and bathroom. So please give me your best way to



run my pipe and what size to use. A. Your circulation is likely to be upset at times when you draw heavily on the boiler for hot water; but this may not be enough to cause any serious trouble. If you can bring *C* into the heater direct by a separate connection from pipe *E* to the boiler, you will perhaps have a better arrangement. Keep the return pipe *C* as high as the top of the boiler, clear over to the heater, then drop straight down. Run *D* higher than *C*, and connect D to the tops of the radiators and *C* out of the bottom openings; then the cooling of the water in the radiators will help the circulation. Better make *C* and *D* 1¼-inch pipe. We suggest 1,589 feet heating surface in the bathrom and 30 in the kitchen; the latter will be plenty if you use a gas stove most of the time for cooking. If you have very little cooking to do, you should supply say 40 feet surface. Be very careful that no one shuts off the cold water supply, unless you have a safety valve on the hot-water system to take care of the expansion strains.

(12417) G. G. asks: How many cubic feet of hydrogen gas would be required to lift a weight of 275 pounds a distance of 100 feet from the earth? How large would be the diameter of a sphere which would hold this gas? Is there any other gas that would be more easy to make and yet be almost as light? A. The lifting power of hydrogen gas is rated at 70 pounds per thousand cubic feet. It would require almost 4,000 cubic feet to lift 275 pounds at sea level, and this quantity would equal a sphere of about 19 feet 9 inches in diameter at normal pressure. There is no other gas which can lift so much, since hydrogen is the lightest substance known.

(12418) B. M. P. asks how to crystallize fruit. A. Make a syrup from 1 pound of sugar and ½ pint of water; stir until the sugar is dissolved, then boil quickly about 3 or 4 minutes. Try by dipping a little in cold water. If it forms a small ball when rolled between the thumb and finger it has attained the desired degree, known as the ball. Throw the fruit to be conserved, a little at a time, into this syrup, let it simmer for a moment, lift with a skimmer, draining free from all syrup. Sprinkle sugar thickly over the boards or tin pans, place the fruit over it in a single layer, sprinkle over thickly with granulated sugar, and place in the oven or sun to dry. When dry, make a syrup as before, and just before it reaches the ball degree add the fruit, stir with a wooden spoon until it begins to grain and sticks to the fruit. When cold, sift off the sugar and put out again to dry. When dry, place in boxes, in layers, between sheets of waxed paper. Keep in a cool, dry place.

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IN the *Scientific American Supplement* we have published in the past few years papers by some of the more eminent physicists and engineers on flying machines. No book thus far published is so complete and so authoritative as these articles. The range of the articles is wide, covering as it does the theoretical side of aviation as well as those more practical aspects which deal with the construction of machines. The following is a partial list of the more important articles which have appeared in the *Scientific American Supplement*; see special note below.

¶ 1816, 1817, 1818, 1819, 1820, 1821 and 1822. **The Practice and Theory of Aviation.** By Grover Cleveland Loening, A. M. This is the most compact paper on aeroplanes that has probably ever been published. Fourteen biplanes and monoplanes are described in detail, and illustrated with scale drawings, namely, the Farman, Cody, Curtiss, Wright, Voisin (old model), Voisin (new model), and Sommer biplanes, and the Antoinette, Santos-Dumont, Bleriot XI, Bleriot XII, Grade, Pelterie and Pfitzner monoplanes. The proper dimensioning of aeroplane surfaces, as deduced by famous experimenters from their tests, is also considered. Taken as a whole this series of seven papers constitutes an admirable text book.

¶ 1713. **The Wright Aeroplane.** This is a thorough description of the old type of Wright biplane with the horizontal elevation rudder in the front of the machine. Excellent diagrams and photographic views accompany the paper.

¶ 1756. **Louis Blériot and His Aeroplanes.** Few people realize that Bleriot's successful monoplane is the result of ten years of daring and perilous experiment. In this paper will be found an instructive description of the evolution of the present successful Bleriot monoplane, illustrated with diagrams and photographs.

¶ 1768. **The Farman Biplane.** A complete description of the Farman biplane, with detail drawings of the box tail and vertical rudders, the manner of working the four ailerons, hand and foot levers which control the machine, plan view and side elevation of the entire machine.

¶ 1767. **The Santos-Dumont Monoplane.** An illustrated article describing the Demoiselle, the smallest and one of the fastest machines thus far made. Sketches accompany the article, showing the details of the construction and control.

¶ 1582. **How to Make a Gliding Machine.** Full details and drawings which will enable anyone to make a glider for $15.00.

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Internal-combustion Engines

(*Continued from page 331.*)

chase of electrical energy. Another railroad coming from Macon to Atlanta, sweeping around in the opposite side of the State from the above-mentioned road, has taken the same step, and all are moving forward with flourishing prospects. A new railway, from the mountainous section of northwestern Georgia down to Atlanta, has declared its intention of abandoning the original idea of electric trains and adopting gasoline power exclusively. All these railroads will be freight and passenger, and will have no steam equipment whatever.

These last-named roads, however, will not use the combination of electrical and gasoline machinery, but will use a mechanical form of transmission such as is used in automobiles—a manufacturer having contracted to supply equipment that will give satisfaction. This will cut out a lot of extra weight and expense.

While it is perhaps too far-fetched a dream to say that the gasoline car will ever displace the long-distance steam locomotives, no more than will electricity, still it cannot be doubted that the internal-combustion engine has come into this new field to stay, and its encroachment upon the domain of steam will be of a greater and more practical extent than has been that of electricity. It does not require a central power station; it does not require a heavy steam locomotive and then a separate train for passengers; it does not require miles and miles of heavy copper wire, and in fact it requires nothing more than the steel rails of the old steam roads, and a higher development of the same power which is economically propelling hundreds of thousands of automobiles, large and small, over roads good and bad. Give this new giant, gas, the smooth rails of the railroad, and the power which the gas engine now puts into the irregularities of a roadway will be put into speed and economy, and the new power will show itself undisputably the master of any other power on earth in point of economy.

This is the viewpoint from which the twentieth century examines anything new, and if it is not economical, if it "does not pay," the twentieth century has no place for it in the ranks of large endeavor. This young giant has been weighed and was not found wanting. He has come to stay.

Forest Fires

DURING the year forest fires burned over an area of 3,000,000 acres, at a rough estimate at a loss of $25,000,000 and the destruction of over 6,000,000,000 feet of timber. Dui'ng 1909 the burned area was 362,014 acres, as compared with 115,000 acres in 1906. It is charged that a considerable number of the fires were caused by incendiarism, which has led the department to offer a reward for the conviction of the incendiaries. Precautionary means are being employed by the department to reduce the fires to a minimum, such as the construction of roads and trails and the establishment of fire lines. During the year 5,500 miles of road and 16,000 miles of trail were completed. It is recommended that the forests be equipped with lookout stations located on high points, with telephonic communication. The principal causes of the fires are given as the severe droughts and railroad locomotives.

Dissolving Glass in Water.—Every kind of glass at a sufficiently high temperature must, it appears from German experiments recently made, eventually show complete solubility in water. Under pressure, glass dissolves in water heated to 410 deg. F. Sea-water more than 660 feet beneath the surface will remain liquid at that temperature, and if it penetrates the earth's crust where the temperature is equally high, it will, apart from the pressure, liquefy the silicates, or glassy rocks. The German experiments point to the conclusion that, at a depth of about five miles, silicates in contact with water are virtually fluid, and that the level of aqueous fusion in the earth is five times nearer the surface than is that of igneous fusion.

Aeronautics

A Luminous Compass for Military Uses.—It is decided to adopt a luminous compass in the German army, and it will be used in military maneuvers so as to allow the troops to find their direction without trouble. Very good results are expected from its use. The compass will have a dial prepared with luminous paint so that it may be seen in the dark.

Flying in Sahara.—Aviation is about to receive its practical extension to the French colonies of Africa by Captain Sido, who embarked at Bordeaux for Dakar recently with four aeroplanes, which are to be used in the colony in the postal and army service. Four aviation officers will follow next month, and will be under the command of General Bonnier. During the first year, when the main object will be to study the atmospheric conditions and the *régime* of winds, the pilots have been instructed to attempt only short flights of fifteen or twenty miles in the vicinity of Dakar, and to keep close to the railway line or highways. They are simply to supplement the postal and medical service, and to keep up rapid communication between the various military posts.

Conditions of the London Daily Mail's Circuit of England by Aeroplane.—The conditions were announced last week of the international aeroplane race around Great Britain which is to occur between July 22nd and August 5th, inclusive. Any aviator having a pilot's license of the International Aeronautic Federation is eligible upon payment of a $500 entrance fee before June 1st. The course is divided into five stages, of which the first—Brooklands to Hendon (20 miles)—will be used to test the speed of the machines. The fastest aeroplane will start first in the race proper, the first stage of which (343 miles) extends from Hendon to Edinburgh; the second from Edinburgh to Bristol (383 miles); the third from Bristol to Brighton (214 miles), and the last from Brighton to Brooklands (40 miles). There will be three or four controls at large cities in each of the long stages, and competitors will be allowed to stop anywhere and make repairs or replacements if forced to do so.

Another New Passenger-carrying Record.—Louis Breguet, one of the leading French experimenters, broke all records for passenger-carrying on March 23rd by taking eleven people on a two-mile flight in his huge biplane. Cable reports give the weight of the live load of twelve as 1,315 pounds—an average of 109 pounds each—and that of the machine as 1,287, making the total 2,602 pounds, or over one and one-quarter tons. This flight is especially noteworthy because M. Breguet flew across country at a height of some 75 feet, thus demonstrating the possibilities of the aeroplane as a transport for troops in time of war. The best previous record at passenger carrying was seven taken up by Le Martin in his Blériot monoplane for an eight-minute flight, although he afterward made jumps with ten people on his machine. Breguet's new record was beaten the next day by Roger Sommer, who carried 12 passengers on his biplane—a total live load of 1,436½ pounds.

Safety Parachute.—Experiments with the new Hervieu safety parachute for aviation continue to be made. Weighing only 15 pounds in all, the device is fastened to a trapeze above the flying man's head. The simple act of releasing the steering lever or wheel and raising a handie spreads the parachute, and the fall is then checked to the rate of only nine feet per second. A dummy weighing 150 pounds was sent from the top of the first floor of the Eiffel Tower. The parachute spread immediately, and the figure landed without the slightest hitch. When the experiments were renewed General Roques and Commandant Renard represented the Ministry of War. The parachute, attached to a dummy figure seated in a full sized aeroplane, again acted with perfect success, and a guinea-pig fastened to the dummy was afterward picked up none the worse for its aerial venture. The inventor is now being pressed to show his confidence in the apparatus by actual experiment on himself. We will publish pictures of the apparatus soon.

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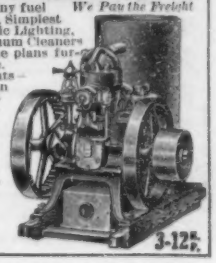
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Electricity

Promoting the Use of Electricity in Germany.—A bureau for the utilization of electricity was recently organized in Berlin by the German electrical industries. Its purpose is to encourage and extend the use of electricity in every way possible. The director is Mr. Einar Wikander. The address of the bureau is Geschäftsstelle für Elektricitäts Verwertung, Potsdamer Str. 68, Berlin W. 57.

Wireless Communication Between Mines.—According to a press dispatch, Drs. Leinbach and Loewy, two German scientists, have established an underground wireless system of communication. They have succeeded in sending messages a distance of nearly a mile and a half at a level of 1,600 feet below the surface, between the potash mines in the North Harz Mountains. The inventors of this system hope that their discovery may be of value in saving life in case of mine disaster.

Complete Demagnetization.—Messrs. E. Gumlich and W. Grogowski, writing in the *Elektrotechnische Zeitschrift*, report their experiments in demagnetization in connection with a study of Pupin coils. They found that by using a demagnetizing alternating current, and reducing this steadily and with perfect uniformity, the smallest trace of magnetism could be removed. However, with commercial rheostats, such uniform reduction of current is impossible, but the experimenters have designed a special apparatus by which this can be accomplished.

Hydro-electric Development in the South.—Mr. George Westinghouse recently addressed the Southern Commercial Congress at Atlanta, Georgia, and presented some very interesting statistics, pointing to the possibilities of hydro-electric development in the Appalachian Mountains. He stated that during the dry season of the year between five million and seven million horsepower could be developed, and that this could be used in the textile mills, fertilizer works, mines, steel mills, and various factories now existing in the South, and that by the use of electricity the production in all these industries would be considerably increased.

Wire Mileage in the United States.—The annual report of the American Telephone and Telegraph Company for last year contains some very interesting statistics. There were 740,027 exchange stations added during the year, making a total of 5,882,719, and 1,200,000 miles of wire were added to the lines, making a total mileage of 12,000,000. Some idea of what this total means may be grasped when we calculate that this length of wire could be wrapped around the earth 500 times and that it would make 50 separate lines from the earth to the moon, but there would not be half enough wire to reach from the earth to our nearest planetary neighbor, Venus.

Old-time Illumination.—In these days of ingenious electric illumination and display, it is amusing to read what the subjects of George II considered a dazzling effect. A Frenchman, visiting London at the time of the coronation of that monarch in 1727, writes enthusiastically in praise of the lighting of the city, as well as of a banquet display. "Most of the streets," said he, "are wonderfully well lighted. In front of each house hangs a lantern, or large globe of glass, inside of which is placed a lamp that burns all night. Large houses have two of these, suspended outside the doors by iron supports. Some even have four." The writer relates that when the coronation procession entered Westminster the light of day was beginning to fade. "Forty chandeliers, in shape like a crown, hung from the ceiling, each having thirty-six wax candles. On the king's appearance all suddenly lighted, and every one in the room was filled with astonishment at the wonderful and unexpected illumination. Little cords of cotton wool, imperceptible to the eye, saturated with sulphur or saltpeter, spirits of wine and other ingredients, had been prepared and arranged so as to carry the flame rapidly from one candle to another. The arrangement had been so skillfully prepared that scarcely a candle failed to take fire."

Engineering

Turret Roof of the "Maine" is Raised.—In driving the cofferdams around the "Maine," the army engineers have encountered certain portions of the wreck, the most notable of which was the 18-ton roof of the forward turret. The force of the explosion was sufficient to shear off the heavy bolts by which it was held down, lift it into the air and throw it laterally some 80 feet from its original position.

Progress at Panama.—The grand total of excavation at Panama to March 1st was 131,829,436 cubic yards, leaving 50,708,330 cubic yards to be excavated. The total for February was 2,714,174 cubic yards. The concrete work advances apace. Fifty-five per cent of the total has been laid at the Gatun locks, over 60 per cent at the Pedro Miguel locks, and over 10 per cent for the locks at Miraflores.

Square-rigged Ship With Oil Engines.—Great interest was aroused by the recent arrival in this port of the French bark "Quevilly," which, with sails furled, moved up New York Bay at a 6-knot gait under her own engines. The "Quevilly" is a four-masted vessel of 3,372 gross tons, which, after several years service, has been furnished with twin screws and motors of 600 horse-power. Her owners are building the largest sailing vessel in the world, which is to have auxiliary oil motors of 1,800 horse-power.

Public Health Promotion.—A department of public health has been established by the American Museum of Natural History, New York. Already there have been prepared a series of models illustrating the pollution of New York harbor by sewage, and various methods for the proper disposal of this material. In addition to the models, there will be exhibited charts and diagrams prepared by the Metropolitan Sewage Commission. Later there will be an exhibit of water supply sanitation.

Remarkable Railway Signal Efficiency.—The Hudson and Manhattan Railway are to be congratulated on the great excellence of their signal plant. During January of this year, out of a total of 8,916,157 movements of signals, stops and switches, there were but four failures, which occurred with the automatic signals. There was not a single failure of the automatic stops, which made nearly three million movements, nor of the interlocked switches, which made over half a million movements.

Fine Locomotive Record.—A four-cylinder balanced compound Baldwin locomotive, which went into service on May 1st, 1906, on the Santa Fé Railway, remained continuously at work until October 22nd, 1910, when after making 241,335 miles, it was sent to the shop for the first general repairs. During this period not a single tube had to be removed from the boiler, which was fed with treated water. Before the treating plants were put in, the tubes had to be removed after 30,000 or 40,000 miles of service.

Illinois Eight-foot Waterway Approved.—The army engineers have reported in favor of building an eight-foot waterway from Chicago through the State of Illinois, at a cost of $20,000,000, and they recommend that, if the locks and bridges cannot be completed within the limits of the $20,000,000 as authorized by the State, the federal government afford the necessary financial assistance. The report states that an eight-foot depth will be sufficient for present conditions, but that if the waterway is to be used by lake and ocean shipping, it must be given an ultimate depth of not less than 24 feet.

Oil Fuel Economical for the Navy.—Charles A. McAllister, Chief Engineer of the Revenue Cutter Service, reports the results of a trial of oil fuel for three months on the revenue cutter "Golden Gate." A comparison of coal consumption for three months in 1909, compared with that of oil for three months in 1910, shows a net saving of $541.08. The cost of coal at $5.40 per ton was $694.44, that of oil at 60 cents per gallon was only $153.32. Another comparison shows the cost of steaming was 54 cents per mile with coal and only 6.9 cents with oil. The personnel, moreover, has been reduced from four to three men. This amounts annually to a saving of $647.

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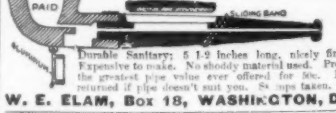

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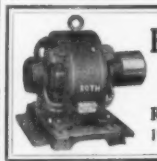

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¶ This work is a companion to the author's elementary work entitled "Dies, Their Construction and Use." It does not go into the details of die making to the extent of the author's previous book, but gives a comprehensive review of the field of operations carried on by presses. This book might well be termed an encyclopedia of die making, punch making, die sinking, sheet metal working, and making of special tools, sub-presses, devices and mechanical combinations for piercing, punching, cutting, bending, forming, drawing, compressing and assembling sheet metal parts and also articles of other materials in machine tools.

American Tool Making and Interchangeable Manufacturing

By JOSEPH V. WOODWORTH. Octavo, 535 pages, 601 illustrations. Price, $4.00.

¶ A complete practical treatise on the designing, constructing, use and installation of tools, jigs, fixtures, devices, special appliances, sheet metal working processes, automatic mechanisms and labor saving contrivances, together with their use in the lathe, milling machine, turret lathe, screw machine, boring mill, power press, drill, sub-press, drop hammer, etc., for the working of metals, the production of interchangeable machine parts and the manufacture of repetition articles of metal. The treatment of each tool described and illustrated is such as to enable any practical man to design, construct and use special tools, dies and fixtures for rapid and accurate production of metal parts interchangeably.

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Science

Cheese as Food.—The Department of Agriculture has recently issued a bulletin in which the value of cheese as a food is set forth. Tests with the respiration calorimeter show that there is no very good reason for eschewing cheese as an article of diet, and that it is more digestible than most people suppose.

The Mystery of the Muluya Dispelled.—In a recent number of *La Géographie* M. Augustin Berard shows that the Muluya does not meander, as most maps indicate, but that this famous Moroccan stream resembles the arrowy Rhone. The Muluya flows with a directness which may well be compared with that of a railroad line. Lastly, it seems that the Muluya is not a natural frontier at all, as Frenchmen have long supposed. Save for its gorges it is a simple stream varying in depth from one to four feet with the season.

Marine Microbe Lamps.—In France, by the cultivation of luminous marine microbes in a liquid medium contained in little glass vessels, there have been produced some of the most curious lamps imaginable. If a few of these living lamps are arranged about a bust in a dark room, the bust is made plainly visible, and photographs may be taken of it. The actinic power of the light is, however, so feeble that several hours' exposure is needed. With another form of lamp, filled with phosphorescent bacteria, enough light is obtained to render a printed page easily legible.

Dew Water.—The ancient "dew ponds" of England have their modern counterparts on the Rock of Gibraltar, where drinking-water is obtained by the condensation of the abundant dew in especially prepared basins. The primitive process consists in making a hollow in the ground, and filling the bottom with dry straw, over which is placed a layer of clay. On a clear night the clay cools very rapidly, and the dew is condensed into water in the basin. The pond is improved by putting a layer of asphalt or Portland cement under the straw. At Gibraltar the present practice is to use wood instead of straw and sheet iron instead of clay.

Age of Fish.—Until within recent years there had been ascertained no trustworthy way of finding out the age of fish. It has been shown that mere size does not indicate the age. Reibisch, Heincke, and others have discovered that many of the bones, scales and otoliths of fishes have annual age-rings, resembling those in tree-trunks, and by means of these Wallace and others have determined the rate of growth of plaice, showing that some specimens attain the age of twenty-five, or even as much as twenty-nine years. Age can now be correlated with size and weight, although it appears that the sexes have a different rate of growth.

Artificial Furs.—A new process for producing artificial furs is described in *La Nature*. The raw pieces of pelt are frozen, and the skin carefully shaved off, thawed and sent to the tanneries to be made into leather. The frozen fur which remains is allowed to thaw slightly at the bottom, so that a small part of the hair is freed from ice. This thawed portion is then covered with a solution of rubber, which is allowed to set. The result is that large seamless pieces of fur are obtained much cheaper than those which come with the natural skin. These same artificial furs are said to be more lasting than the real, because they are immune from the attacks of moths.

The New Chemists' Building in New York.—The Chemists' Building Corporation, of which Prof. Morris Loeb is president, formally celebrated the opening of its new building in New York recently. The structure is twelve stories high. The lower half of it is devoted to the Chemists' Club, which has been in existence for twelve years, and up to the present time occupied the old Mendelssohn Glee Club house in West 55th Street. The new quarters were built at a cost of $500,000. One of the special features of the building is the board room, which has been fashioned to represent a laboratory in the days of alchemy. The auditorium is dedicated to the memory of Benjamin Thompson, Count Rumford.

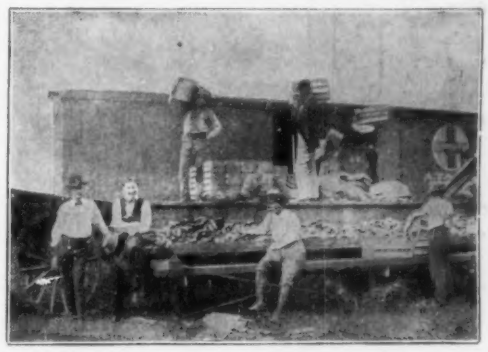
Cucumbers *versus* Corporations

By FRANKLIN O. KING

The Tendency of the Times is More and More toward Centralization. Vast aggregations of Great Wealth have fastened their Tentacles on most of the Natural Resources of our Country, and the chances of the Wage-Earner seem to grow Less each Year. By the "Wage-Earner" I mean the Man who Toils by Hand or Brain at a Daily wage or on a Monthly salary for some great Corporation, and by the same Token, my Friend, I mean YOU.

You Cannot "Make a Silk Purse out of a Sow's Ear," nor "Gather Figs from Thistles." Mincing Matters Will not Mend Them, and the Sooner You Open Your Eyes to Existing Conditions, the Quicker You Will Take Steps to Get Out of the Rut into which You have Fallen.

When You get Your Pay Envelope Saturday Night, You Know Full well where almost Every Dollar of It is Bound to Go. After the Butcher, and Baker and Candlestick-Maker—and the Landlord—Get Theirs, there isn't Much Left for Anybody Else. You have to Work Harder to Get a Dollar Today than ever Before, and the same Dollar will Buy Less than at any Time in Our History.



Cucumbers In Carload Lots

Having refreshed your Memory, let me suggest a Remedy. Why Don't You Have the Courage to Pull Up Stakes and Start for a New Country? Other Men have done it, Why Not You? You Know Full Well that the Farmer is the most Independent Man in this Broad Land of Ours Today. He is Working for Himself—Getting 100 Cents of Every Dollar he Earns His Children are Better Clothed and Better Fed, and the State University and Other Educational Institutions have More Students Enrolled from Farming Communities than any other Sections of this Country. The Farmer Feeds Us All, but He Gets Well Paid for it, and Nowhere else are his Returns so Large, or his Profits so Certain as in the Rain Belt of the Texas Gulf Coast.

These Gulf Coast Lands are Producing up to $1000 an Acre for Oranges, and the Growers of Strawberries and Early Vegetables Net $300 to $500 an Acre each Crop—and Grow Three Crops a Year in some instances. Just think of Raising Strawberries, Potatoes, Cabbage, Cucumbers, Spinach and other Vegetables in December, January, February, and March. You who have bought Them in these Months know what they Cost. Many Instances can be shown where Colonists have Paid for their Land with their First Year's Crop—and even from One Crop.

Owners of Orange and Fig Orchards in the Texas Gulf Country are becoming Wealthy on a Small Acreage. Mr. N. E. Stout sold $6,383 worth of Satsuma Oranges from 6½ Acres last Year. His 1,500 Fig Trees brought Him $1,893.80, or more than $1.25 per Tree. Mr. P. I. Gill made $800 per Acre from Oranges in 1908 and $1000 per Acre in 1909. With both Oranges and Figs a Man can Plant Vegetables between the Rows and have a Sure Source of Income while his Trees are coming into Bearing.

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April 1 issue SCIENTIFIC AMERICAN

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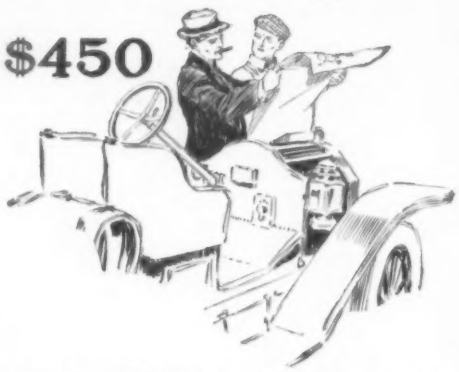

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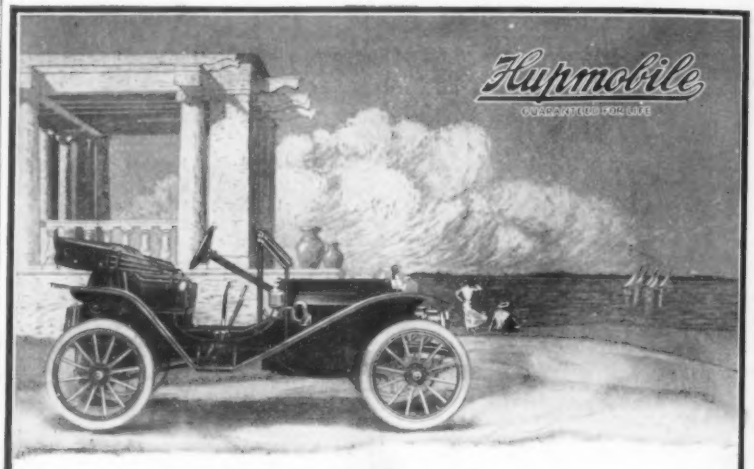

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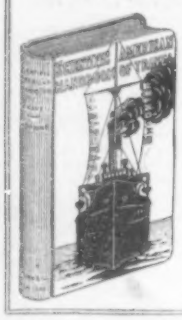

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Lighting and Heating

April Magazine Number of the Scientific American, Issue of April 15th

WE are going to tell you in the Scientific American something about these branches of engineering, what is being done and how it affects you in your home, in your office, in your business. A series of articles has been specially prepared by well-known authors who can write correct science in simple language. The subjects of this series have been selected not merely for the purpose of entertainment, but to provide information that will be of practical value to you.

Tasteful Use of Light
By Louis C. Tiffany

Light and Shadows
By E. C. Crittenden

Lamps of Today
By Joseph B. Baker

Inventing the Light of the Future
By W. B. Kaempffert

Lighting the Country Home
By Putnam A. Bates

Good Coal and Poor
By Joseph A. Holmes

Heat from Dust
By Charles L. Wright

Heating the Home
By James F. Martine

All these articles will appear as an addition to the regular Scientific American. There will, for instance, be the usual Aviation page, the abstracts from current periodicals, the Inventor's Department, and many other interesting articles

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